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PANAMANIAN SCARABAEINAE: TAXONOMY, DISTRIBUTION, AND HABITS (COLEOPTERA, SCARABAEIDAE)

By

H. F. Howden and O. P. Young

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H.F. Howden[1] and O.P. Young[2]

ABSTRACT

Twenty-one genera of Scarabaeinae that occur in Panama are briefly reviewed. In addition the genus *Cryptocanthon* is included since it occurs on either side of Panama. A total of 113 species are recognized with twenty-eight described as new. The old and new taxa are listed below in the Contents. Zoogeographic and ecological data were compiled from a total of 7113 Panamanian specimens bearing accurate data.

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PANAMANIAN SCARABAEINAE:
TAXONOMY, DISTRIBUTION, AND HABITS
(COLEOPTERA, SCARABAEIDAE)

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INTRODUCTION

In the last decade interest in the biology and behavior of dung beetles belonging to the subfamily Scarabaeinae has increased greatly. This has been due in part to the interest in their utility both as a natural sanitation system and as an agent for pasture improvement (e.g., Weeda, 1967). From the ecological point of view, the various methods utilized by the beetles for partitioning the dung resource are extremely interesting and complex. However, in order to adequately study and document the habits of the Scarabaeinae for any geographic area the species must be taxonomically well known. The inadequate taxonomic status of the Panamanian Scarabaeinae stimulated the initiation of this review. The only previous publication that has attempted to enumerate and describe the Panamanian species of Scarabaeinae is the Scarabaeidae volume by H.W. Bates (1886-1890) of the *Biologia Centrali-Americana*. In this volume Bates lists 58 species from Panama. The present survey reviews 113 species in 21 genera, giving brief descriptions, keys, and biological information for the Panamanian species.

NOMENCLATORIAL LIMITATIONS

Since this work is intended as a review and not as a revision, the reader should recognize the inherent limitations in the application of the scientific names used. Of primary importance is the recognition that nomenclature and taxonomy are not inseparable. For Panama we hope that our taxonomy is reasonably good although our nomenclature, in some cases, is doubtful. Taxonomically we have attempted to define the species, including variation, from specimens taken in Panama. We have not included in the descriptions non-Panamanian material (as should be done in a revision). In many cases specimens from Costa Rica or Colombia differ slightly and consistently from Panamanian specimens. Frequently we have briefly mentioned these differences. However, when describing a new species we have excluded most non-Panamanian material from the type series because of these small but consistent differences. From the nomenclatorial standpoint we have attempted to apply names as broadly as possible. If a species was described from Colombia and a slight variant occurs in Panama, we have used the available name and avoided proposing a new name.

Correct nomenclature often depends on the examination of types, and here again we lack the degree of accuracy that one would expect to find in a revision. However, a number of the types have been seen as noted in the descriptive section. The

Biologia material has been carefully studied, but where no type has been designated for a cotypic series, we have refrained from doing so. Lectotype selection should await proper revisionary studies.

If our nomenclature should prove to be inaccurate, it can be changed. This should be a relatively rare necessity since a reasonable effort has been made to verify the names used herein.

MATERIAL EXAMINED

The specimens seen were derived largely from two sources. The first source was museum holdings accumulated over a period of years. These accumulations, while often lacking ecological data other than date and locality, were valuable both taxonomically and historically. In some cases, due to clearing of land or other types of habitat disturbance, a species may no longer occur in an area. Thus, some of the older material was of considerable historical importance. The second source of specimens consisted of recent intensive collecting efforts by both ecologists and systematists. The authors alone totalled nearly two man years of collecting and observations in Panama, and numerous individuals, as mentioned in the Acknowledgments, assisted us. Much of the biological information discussed was accumulated by this recent effort.

COLLECTIONS STUDIED

In citing the collections studied we utilize the name of the city in which the museum is situated, and for a private collection, we cite the individual's last name. The museum collections studied and the curators assisting are as follows:

Cambridge	Museum of Comparative Zoology, Harvard University. A. Newton.
Chicago	Field Museum of Natural History. H. Dybas.
London	British Museum (Natural History). R. Pope.
Ottawa	Canadian National Collection, Biosystematics Research Institute. A. Smetana.
Paris	Museum National d'Histoire Naturelle. A. Descarpentries.
Washington	United States National Museum. R. Gordon.

Types cited as "Howden" are deposited on loan in the Canadian National Collection, Biosystematics Research Institute, Canadian Department of Agriculture, Ottawa, Canada.

GAZETTEER OF LOCALITIES

Because one of the objectives of this survey is to encourage biological investigations in Panama, we have devoted considerable effort to organizing and presenting the 120+ localities that are represented in our examined material. A few locality names were added after the manuscript was essentially complete; these are not included in Table 1. If nothing else, Table 1 combined with Figure 1 should indicate how unevenly entomologists have collected in Panama.

LOCALITY DATA

Most of the place names used in this review are standard names approved by the Board on Geographic Names, U.S. Department of the Interior, as published in 1969 as Official Standard Names Gazetteer No. 110, Panama and the Canal Zone. The Panama Gazetteer provided latitude and longitude coordinates, which, according to its procedures, "were read at the map symbol for populated places and other entities occupying limited sites, at the mouths or lower ends of streams, at the summits of mountains and hills, at the extremities of capes and points, and near the centers or midpoints of other features". Several names not found in the Panama Gazetteer were located in The Gazetteer of Selander and Vaurie (1962). Localities that could not be authenticated in a gazetteer were usually located on one of several maps, such as the Esso Standard Oil road map of "La Republica de Panama", 1964. To determine each locality's elevation above sea level and its relation to nearby major features, several other maps were utilized. These included U.S. Army Corps of Engineers, Army Map Service, Series: #1301-- 1:1,000,000 - Panama and Central America; #E461-- 1:500,000 - Panama; #E661-- 1:100,000 - Canal Zone; #E761-- 1:50,000 - Panama, Topographical.

The Army Map Series #E761 maps provided exact or contour elevation data, but unfortunately only central Panama has been mapped at a scale of 1:50,000. Hence, for much of Panama, Army Map Series #E461 was used. This map, however, indicated elevations in zones of 0-200 meters, 200-500 meters, 500-1000 meters, 1000-2000 meters, and >2000 meters. Although mountain elevations are for the summit and river elevations are for the mouth, it is understood that specimens collected at mountains or rivers may not have been at the elevation indicated in the locality list. Distance measurements given in the locality list (but not on label data) are straightline measurements obtained from maps and are not road distances. Locality names found on specimen labels that can not be authenticated and located by coordinates are not listed in the main table, but are given separately. When necessary, locality names on specimen labels were corrected for spelling before listing.

TABLE 1. PANAMA COLLECTING LOCALITIES.

LOCALITY	COORDINATES		ELEVATION	RELATION TO NEAREST MAJOR FEATURE
	N	W	Meters	
BOCAS DEL TORO PROVINCE				
Almirante	9°18'	82°24'	129	58 km north of Boquete
Changuinola District	9°15'	82°39'		
Rio Changuinola	9°28'	82°27'	<200	19 km NW of Almirante, flowing north into Caribbean
CANAL ZONE				
Ancon Hill	8°57'	79°33'	256	Adjacent to Balboa
Balboa	8°57'	79°34'	20	Adjacent to (west of) Panama City
Barro Colorado Island	9°09'	79°51'	<161	16 km WNW of Gamboa
Cabima	9°13'	79°53'		19 km from Colon, submerged by the Canal in 1914
Camaron Arm	9°01'	79°36'	<20	2 km NE of Pedro Miguel
Camp Chagres	9°13'	79°37'	25	near Madden Dam
Canoa Saddles	9°21'	79°48'	60	Extreme north end of Gatun Lake, near Santa Rita Ridge
Chiva Chiva	9°02'	79°35'	55	3.5 km NE of Pedro Miguel
Coco Solo	9°21'	79°52'	10	3 km NE of Colon
Cocoli	8°59'	79°35'	20	5 km WNW of Ancon Hill
Corozal	8°59'	79°34'	10	3.5 km NW of Ancon Hill
Cristobal	9°21'	79°55'	10	Adjacent to (south of) Colon
Curundu	8°59'	79°33'	20	3 km N of Ancon Hill
Empire (=Empire Known Distance Range)	9°04'	79°40'	60	7 km SSE of Gamboa
Farfan (=Farfan Naval Radio Station)	8°56'	79°35'	31	4 km NE of Ft. Kobbe
Fort Clayton Army Reservation	9°01'	79°34'	20	6 km NW of Ancon Hill

LOCALITY	COORDINATES		ELEVATION	RELATION TO NEAREST MAJOR FEATURE
	N	W	Meters	
Fort Gulick Army Reservation	$9^{\circ}19'$	$79^{\circ}52'$	20	5.5 km SSE of Colon
Fort Kobbe Army Reservation	$8^{\circ}54'$	$79^{\circ}35'$	30	6.5 km SW of Ancon Hill
Fort San Lorenzo	$9^{\circ}19'$	$80^{\circ}00'$	10	Within the Fort Sherman Military Reservation, on banks of Chagres
Fort Sherman Military Reservation	$9^{\circ}20'$	$79^{\circ}58'$	<106	5 km W of Colon
Fort William D. Davis	$9^{\circ}17'$	$79^{\circ}54'$	10	8 km S of Colon
France Field (=France Field Naval Air Station)	$9^{\circ}21'$	$79^{\circ}53'$	10	2.5 km E of Colon
Frijoles	$9^{\circ}10'$	$79^{\circ}48'$	30	12 km WNW of Gamboa
Gamboa	$9^{\circ}07'$	$79^{\circ}42'$	40	23 km NW of Ancon Hill
Gatun	$9^{\circ}16'$	$79^{\circ}55'$	20	10 km SSW of Colon
Isla de los Chivos	$9^{\circ}02'$	$80^{\circ}04'$	30	29 km SW of Barro Colorado Island; in Gatun Lake, near mouth of Rio Ciricito
Madden Dam	$9^{\circ}13'$	$79^{\circ}37'$	60	14 km NE of Gamboa
Madden Forest (=Madden Forest Timber Preserve)	$9^{\circ}06'$	$79^{\circ}37'$	120	9 km E of Gamboa
Margarita	$9^{\circ}20'$	$79^{\circ}54'$	10	4 km SSE of Colon
Mojinga Swamp	$9^{\circ}18'$	$79^{\circ}58'$	10	10 km SW of Colon
Palo Seco (=Palo Seco Leprosarium)	$8^{\circ}55'$	$79^{\circ}34'$	15	3 km E of Ft. Kobbe, on beach
Paraiso	$9^{\circ}02'$	$79^{\circ}38'$	55	2 km NW of Pedro Miguel
Pedro Miguel	$9^{\circ}01'$	$79^{\circ}37'$	30	10 km NW of Ancon Hill
Pipeline Road	$9^{\circ}09'$	$79^{\circ}43'$	<120	5 km NW of Gamboa
Rio Agua Salud	$9^{\circ}11'$	$79^{\circ}47'$	30	Crossed by Pipeline Road, flows into Gatun Lake
Rio Chagres	$9^{\circ}19'$	$80^{\circ}00'$	30	Flows into Gatun Lake at Gamboa, exits at Gatun Locks
Rio Ciricito	$9^{\circ}01'$	$80^{\circ}05'$	30	Flows into Gatun Lake
Rio Frijoles	$9^{\circ}09'$	$79^{\circ}46'$	30	Crossed by Pipeline Road, flows into Gatun Lake

LOCALITY	COORDINATES		ELEVATION	RELATION TO NEAREST MAJOR FEATURE
	N	W	Meters	
Rio Trinidad	9°01'	79°58'	30	Flows into Gatun Lake
Rodman (=Rodman Naval Station)	8°57'	79°35'	10	2 km W of Balboa
Summit Park	9°04'	79°39'	450	8 km SE of Gamboa
Tabernilla	9°10'	79°48'		Station on railroad south of Frijoles, submerged in 1914
U.S. Army Tropic Test Center (="Skunk Hollow" and "Black Tank Road")	9°18'	79°57'	25	5 km NW of Gatun
CHIRIQUI PROVINCE				
Alanje	8°24'	82°33'	<200	14 km WSW of David
Algarrobo	8°20'	81°34'	500-1000	18 km NE of Tole
Baldwin Forest	8°51'	82°36'	1760	2 km W of Cerro Punta
Bambito	8°50'	82°37'	1000-2000	6 km SW of Cerro Punta
Boqueron	8°30'	82°34'	200-500	18 km WNW of David
Boquete	8°47'	82°26'	500-1000	37 km N of David
Bugaba	8°29'	82°37'	<200	5 km S of Concepcion
Cerro Pando	8°55'	82°43'	2441	18 km NW of Hato del Volcan
Cerro Punta (town)	8°51'	82°34'	1000-2000	13 km NNE of Hato del Volcan
Cerro Punta	8°53'	82°35'	2000-3000	3 km W of Cerro Punta
Concepcion	8°31'	82°37'	200-500	23 km WNW of David
David	8°26'	82°26'	<200	70 km WNW of Remedios
Dolega	8°34'	82°25'	200-500	18 km N of David
Galera de Chorcha	8°26'	82°13'	200-500	22 km E of David
Guabala	8°13'	81°41'	200-500	3 km SSW of Tole
Gualaca	8°32'	82°18'	200-500	18 km NE of David
Hartmann's Finca	8°51'	82°36'	1000-2000	15 km NW of Hato del Volcan
Hato del Volcan	8°46'	82°38'	1000-2000	29 km N of Concepcion
Las Lagunas	8°46'	82°41'	1000-2000	6 km W of Hato del Volcan

LOCALITY	COORDINATES N	COORDINATES W	ELEVATION Meters	RELATION TO NEAREST MAJOR FEATURE
Los Pozos	8°52'	82°41'	1000-2000	13 km NW of Hato del Volcan
Neuva California	8°47'	82°39'	1490	3 km NW of Hato del Volcan
Palo Santo	8°49'	82°41'	1000-2000	7 km NW of Hato del Volcan
Potrerillos (Abajo)	8°39'	82°29'	500-1000	4 km NW of Dolega
Potrero de Cana (=Potera)	8°18'	81°43'	500-1000	5 km NW of Tole
Progresso	8°27'	82°50'	<200	24 km WSW of Concepcion
Remedios	8°14'	81°49'	<200	18 km W of Tole
Rio Caldera	8°37'	82°21'	200-500	10 km NE of Dolega; tributary of Rio Chiriqui
Rio Candela	8°46'	82°50'	200-500	22 km W of Hato del Volcan
Rio Chiriqui Viejo	8°20'	82°42'	<200	23 km SSW of Concepcion
Rio Tabasara	8°00'	81°39'	<200	24 km SSE of Tole
Rovira	8°38'	82°29'	500-1000	13 km NW of Dolega
Santa Clara	8°50'	82°45'	1000-2000	8 km WSW of Hato del Volcan
Tole	8°14'	81°41'	200-500	77 km WNW of Santiago
Volcan de Chiriqui (=El Volcan)	8°48'	82°33'	3475	8 km SSE of Cerro Punta
COCLE PROVINCE				
Aguadulce	8°15'	80°33'	25	38 km SSW of Penonome
Anton	8°24'	80°16'	30	18 km SE of Penonome
El Valle (town)	8°36'	80°08'	600	29 km ENE of Penonome
Penonome	8°31'	80°22'	87	74 km SW of La Chorrera
Rio Guaybo	8°36'	80°08'	600	Tributary of Rio Anton, flows through town of El Valle
Rio Hato	8°23'	80°10'	<20	30 km ESE of Penonome
COLON PROVINCE				
Alhajuela	9°13'	79°38'		Midway on road between Panama City and Colon, submerged by Madden Lake
Colon District	9°17'	79°45'	<20	Caribbean entrance to Canal
Pina	9°17'	80°03'	10	15 km W of Gatun

LOCALITY	COORDINATES N	COORDINATES W	ELEVATION Meters	RELATION TO NEAREST MAJOR FEATURE
Portobelo	9°33'	79°39'	<20	34 km NE of Colon
Santa Rita Ridge	9°19'	79°47'	270	14 km ESE of Colon, within Gatun Lake Watershed
DARIEN PROVINCE				
Cerro Tacarcuna	8°05'	77°17'	<1875	50 km E of El Real
El Real (de Santa Maria)	8°08'	77°43'	<200	54 km SE of La Palma, on Rio Tuira
Rio Tacarti	8°39'	77°43'	200-500	56 km ENE of La Palma, a tributary of Rio Membrill
Santa Fe	8°39'	78°09'	<200	27 km N of La Palma, on Rio Sabana
LOS SANTOS PROVINCE				
Cerro La Venta	7°39'	80°22'	500-1000	30 km S of Los Santos
Macaracas	7°44'	80°33'	100-200	27 km SW of Los Santos
Tonosi	7°23'	80°26'	<200	61 km S of Los Santos, 8 km upriver (NW) from mouth of Rio
PANAMA PROVINCE				
Arraijan	8°57'	79°39'	165	8 km WNW of Fort Kobbe
Bella Vista	8°59'	79°31'	8	2 km NE of Ancon Hill
Cermeno	8°44'	79°51'	162	17 km SSW of La Chorrera
Cerro Azul	9°10'	79°24'	500-1000	10 km N of Tocumen
Cerro Campana	8°41'	79°55'	992	4.5 km SW of La Campana
Cerro Jefe	9°14'	79°23'	1007	18 km N of Tocumen
Chepo	9°10'	79°06'	50	32 km ENE of Tocumen
Isla Taboga	8°47'	79°33'	300	17 km S of Panama City
Juan Mina	9°10'	79°39'	<200	7 km NE of Gamboa; on banks of Rio Chagres
La Campana	8°43'	79°54'	135	5.5 km WSW of Cermeno
La Chorrera	8°53'	79°47'	84	16 km SW of Arraijan

LOCALITY	COORDINATES N	 W	ELEVATION Meters	RELATION TO NEAREST MAJOR FEATURE
Las Cumbres	9°05'	79°32'	200-500	13 km N of Panama City
Maje	9°10'	78°46'	<200	37 km E of Chepo
Panama City	8°58'	79°32'	20	Pacific entrance to Canal
Pearl Islands (=Archipielago de las Perlas)	8°25'	79°00'	<200	90 km SE of Panama City
Rio la Jagua	9°02'	79°09'	<200	13 km SSW of Chepo
Rio Las Lajas	9°02'	79°26'	<200	8 km SW of Tocumen
Rio Pequeni	9°21'	79°33'	<200	Flows into north end of Madden Lake
Rio Sajalices	8°38'	79°50'	<200	8 km NNE of Chame
San Isidro	9°04'	79°31'	<200	13 km W of Tocumen
Tocumen	9°05'	79°23'	<200	19 km NE of Panama City
Vaca Monte	8°52'	79°40'	20	10 km SSW of Arraijan
VERAGUAS PROVINCE				
Farallon	8°05'	81°23'	200	35 km SE of Tole
Los Algarrobos	7°45'	81°04'	200	12 km S of Santiago
Potrerillos	8°20'	80°56'	200-500	30 km NNE of Santiago
San Pedro	8°08'	81°05'	200	10 km W of Santiago

LOCALITIES NOT ADEQUATELY LOCATED

CANAL ZONE - La Sabanas

CHIRIQUI PROVINCE - Finca Lerida (near Boquete); El Valle de Nubes (4500 ft.); Repr. la Fortuna.

DARIEN PROVINCE - Cerro Mali

PANAMA PROVINCE - Bayano Bridge (<200 M); Rio Aguacate

PROVINCE UNKNOWN - Las Mercedes; Rio Penequate Espino

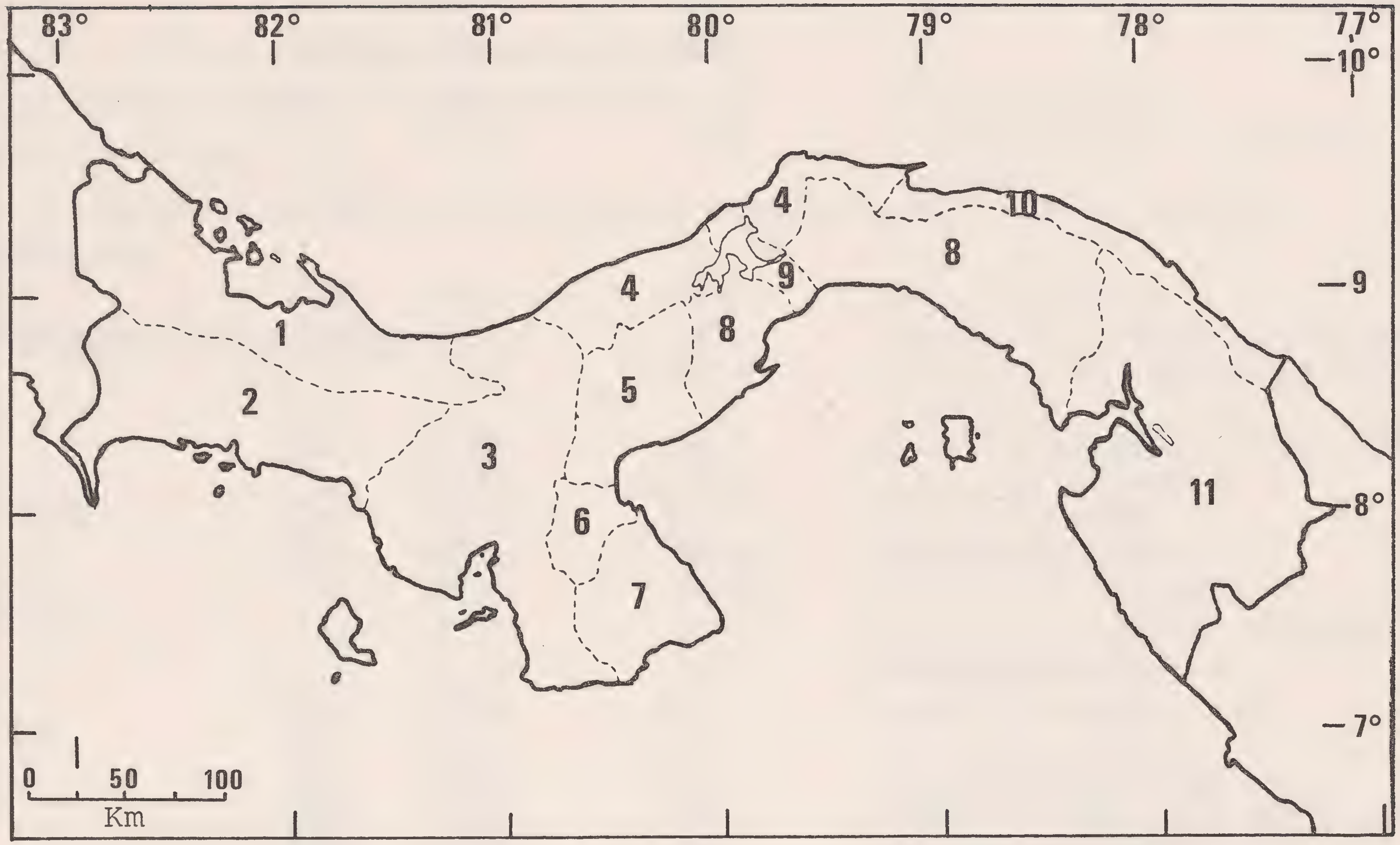

Fig. 1. Provinces of Panama

1. Bocas del Toro
2. Chiriqui
3. Veraguas
4. Colon
5. Cocle
6. Herrera
7. Los Santos
8. Panama
9. Canal Zone
10. San Blas
11. Darien

TAXONOMY OF THE SCARABAEINAE

Panamanian species belonging to the subfamily may be distinguished from other Scarabaeidae by the following combination of characters: antenna nine or ten segmented with a three segmented club; mandible and maxilla partly membranous; mandibles not visible from above, clypeus large; pygidium exposed, not covered by elytra; mesosternum short; middle coxae widely separated, obliquely placed; spiracles present in lateral membranes of abdomen; posterior tibia with a single apical spur; tarsal claws, when present, simple.

The species are primarily dung and/or carrion feeders, at least in the adult stage.

Key to Genera of Scarabaeinae occurring in Panama

1. Scutellum clearly visible between bases of elytra . . . 2
Scutellum not visible between bases of elytra 3

2(1). Clypeus shallowly, broadly emarginate; body rectangularly elongate, flattened dorsally . . . . Eurysternus Dalm. (p. 14)
Clypeus anteriorly bidentate; body shape oval, dorsally convex . . . . Megathoposoma Balth. (p. 18)

3(1). Middle and hind tibiae dilated apically or broad and flattened; hind tibia if not dilated at apex then at basal third distinctly rectangular in cross section 4
Middle and hind tibiae slender, frequently curved, scarcely enlarged apically; hind tibia at basal third trapezoidal in cross section 19

4(3). Fore tibia with four teeth on outer margin; hind tarsus with basal segment not expanded apically, elongate, as long as tibial spur . . . . Onthophagus Latr. (p. 93)
Fore tibia with three or four teeth on outer margin, if with four teeth hind basal tarsal segment expanded apically, not slender 5

5(4). Anterior tarsus absent, or if present without claws; basal segment of antennal club hollowed, receiving other segments 6
Anterior tarsus present and with claws; basal segment of antennal club not distally concave . . . 9

6(5). Antero-median angle of metasternum prolonged as a long, sharp spine extending between apices of the front coxae; postero-median edge of pronotum, distinctly angulate between bases of elytra . . . . Oxysternon Lap. (p. 146)

Antero-median angle of metasternum not spiniform; postero-median edge of pronotum not distinctly angulate 7

7(6). Anterior clypeal margin with three indentations delimiting two acute teeth . . . . *Coprophanaeus* Ols. (p. 140)
Anterior clypeal margin with a single median indentation, sometimes obsolete; margin lacking distinct, acute teeth 8

8(7). Outer pronotal margin just posterior to anterior angle notched or abruptly sinuate; anterior pronotal marginal bead not broken behind eye; pronotum of male not flattened, not triangular in shape . . . . *Sulcophanaeus* Ols. (p. 137)
Outer pronotal margin posterior to anterior angle not notched nor abruptly sinuate; anterior pronotal marginal bead broken just behind eye; pronotum of male usually flattened, triangular in shape . . . . *Phanaeus* Macl. (p. 134)

9(5). Elytron with 7 or 8 discal striae (a 9th sometimes present on epipleuron), or striae obscured by dense punctures and/or setae; median longitudinal pronotal groove weakly developed or absent 10
Elytron with 9 discal striae (10th on epipleuron); median longitudinal pronotal groove usually strongly developed . . . . . . *Copris* Geof. (p. 130)

10(9). Entire dorsal surface moderately to densely punctate, or with dorsal setae on head, pronotum and elytra 11
Dorsal surface not as above 12

11(10). Body shape rectangular; elytral intervals not distinctly convex; anterior margin of clypeus not sharply dentate . . . , . *Bdelyrus* Har. (p. 46)
Body shape oval; elytral intervals may be distinctly convex; anterior margin of clypeus dentate, teeth acute . . . *Pedaridium* Har. (p. 42)

12(10). First segment of hind tarsus triangular; clypeus often rugose, sometimes with coarse punctures . . . 13
First segment of hind tarsus slender or broadly rectangular and with truncate or rounded apex; clypeus not distinctly rugose, often smooth or finely punctate, sometimes coarsely punctate . . . 14

13(12). Hind coxa in extreme posterior position, with strong median ventral reduction in width of abdominal segments; middle coxae separated by distance of less than width of middle femur . . . . *Ontherus* Er. (p. 121)

Hind coxa more anterior, with six abdominal segments easily identifiable; middle coxae separated by distance greater than width of middle femur . . . . . . *Dichotomius* Hope (p. 123)

14(12). Lateral pronotal fovea round, without depression or row of punctures immediately anterior to fovea; usually seventh elytral stria, excluding scattered punctures, not extending to anterior margin. 15

Lateral pronotal fovea oval or oblong, with a row of coarse punctures and/or a longitudinal groove in line with fovea; seventh elytral stria extending to anterior margin 18

15(14). Body shape rectangular, elongate; dorsally flattened; fifth ventral abdominal segment medially shorter than fourth or sixth, the sixth segment four to five times longer than fifth . . . . *Onthocharis* Westw. (p. 47)

Body shape not as above; fifth abdominal segment not as above 16

16(15). Mesosternum distinct; first segment of posterior tarsus gradually enlarged toward the apex; first five abdominal segments narrowed medially, sixth longer 17

Mesosternum very short; basal segment of posterior tarsus very elongate, scarcely enlarged: median ventral abdominal segments of approximately equal length . . . .*Canthidium* Er. (p. 71)

17(16). Pygidium with a deep, nearly median transverse sulcus; body moderately convex . . . . *Agamopus* Bates (p. 40)

Pygidium lacking a median transverse sulcus; body strongly convex . . . .*Ateuchus* Weber (p. 68)

18(14). Mesosternum smooth or nearly so; lateral pronotal groove pronounced, impunctate to feebly punctate . . . . *Uroxys* Westw. (p. 50)

Mesosternum distinctly punctate; lateral pronotal punctures delimiting or forming irregular groove . . . . *Scatimus* Er. (p. 48)

19(3). Posterior edge of vertex not abruptly declivous, at most only slightly so behind or between the eyes 20

Posterior edge of vertex clearly declivous 21

20(19). Eyes not visible from above without protracting the head; elytral disc carinate laterally. . . . . *Cryptocanthon* Balth. (p. 39)

Eyes visible from above with head fully retracted; elytral disc lacking lateral or apical carinae . . . . *Pseudocanthon* Bates (p. 35)

21(19). Lateral margin of elytral disc at or behind umbone with strong carina(e); third to seventh intervals often briefly carinate near apices . . . . *Deltochilum* Esch. (p. 36)
Elytra lacking carina(e) and apical prominences . . . . *Canthon* Hoff. (p. 19)

Eurysternus Dalman

Eurysternus Dalman, 1824, p. 8.
Type-species: *Scarabaeus caribaeus* Herbst (= *Eurysternus planus* Dalm.), listed by Lucas, 1920.
Aeschrotes Serville, 1828, p. 357.

Eurysternus, as presently delimited, may be recognized by the following combination of characters: body shape elongate, clypeus lacking teeth, labial palpus with two segments, elongate scutellum visible, elytral disc often flattened and with a sharp lateral carina delimiting epipleuron, elytron with eight striae, and mesosternum short.

The genus is in need of revision, hence some of the names used herein may be incorrectly assigned.

Key to species of *Eurysternus*

1. Posterior margin of hind femur straight, tooth (if present) basal 2
Posterior margin of hind femur curved or sinuate, tooth (if present) median or in distal half . . . 3

2. Anterior margin of fore femur feebly arcuate; length 14 to 17 mm . . . . 1. *claudicans* Kirs.
Anterior margin of fore femur angulate; length 7 to 11 mm. . . . . 2. *plebejus* Har.

3. Posterior margin of hind femur with tooth or tubercle; length 17 mm or less 4
Posterior margin of hind femur lacking tooth or tubercle; length 17 to 22 mm . . . 3. *velutinus* Bates

4. Posterior margin of prosternum straight or very slightly arcuate (Fig. 4); length 11 to 14 mm . . . . 4. *mexicanus* Har.
Posterior margin of prosternum angular or sinuate . 5

5. Posterior portion of prosternum smooth, margin angulate (sometimes feebly) medially (Fig. 3); posterior femur gradually expanded in apical half; length 14 to 18 mm . . . . 5. *caribaeus* Hbst.

Posterior portion of prosternum with tubercle on either side of midline, margin sinuate; posterior femur abruptly expanded in apical half; length 15 to 19 mm . . . . 6. magnus Lap.

1. Eurysternus claudicans Kirsch

Fig. 8

Eurysternus claudicans Kirsch, 1870 (1871), p. 360.

Type, Dresden (?). Not seen.

Length 14 to 17 mm. Dull brown to brownish black dorsally. Dorsal setae short, inconspicuous. Pronotum irregularly tumid either side of midline, often with four shining, impunctate spots in arc across anterior third. Elytra not mottled; striae distinct, represented by depressed double lines widened by shallow, indistinct punctures. Metasternum not depressed in center, longitudinal median third smooth except for scattered coarse punctures. Hind femur (Fig. 8) usually toothed at basal sixth, posterior margin otherwise straight, hind tibia of females (in dorsal view) bent and sinuate in apical third.

MATERIAL EXAMINED. PANAMA, 58 specimens from: BOCAS DEL TORO PROV. - Rio Changuinola. CANAL ZONE - Barro Colorado Island; Frijoles; Madden Forest; Rio Trinidad. PANAMA PROV. - Cerro Campana; Las Cumbres. COLLECTION DATES: February, April, May, June, July, August, September, October, November, December.

OTHER COUNTRIES, 29 specimens from: MEXICO, NICARAGUA, COSTA RICA, COLOMBIA, PERU.

REMARKS. This species has been collected at agouti, rat, tamandua, and unknown carrion; on feces of the howler monkey, man, spider monkey, and tapir; and on leaf surfaces. On Barro Colorado Island, claudicans is active nocturnally, particularly in the period from 1800 to 2000 hours. The species is most abundant during the wet season, and is equally abundant on both carrion and feces. In Panama claudicans occurs primarily in lowland forests.

2. Eurysternus plebejus Harold

Figs. 2, 9

Eurysternus plebejus Harold, 1880, p. 14.

Type or cotype, Paris. Not seen.

Length 7 to 11 mm. Dorsally brown mottled with black or dark brownish black mottled with brown; dorsal setae frequently conspicuous, particularly on elytral apices. Pronotal punctures ocellate, surface dull between punctures, usually lacking conspicuous, impunctate shining spots; surface slightly irregular, frequently feebly depressed medially in posterior fifth. Elytral striae (Fig. 2) feebly impressed. Metasternum centrally with shining shallow depression. Hind femur (Fig. 9) lacking tooth on posterior margin in males, a small tooth present at basal sixth in females. Fore femur with distinct median obtuse angle on ventral (tibial) edge. Hind tibia not sinuate or strongly bent.

MATERIAL EXAMINED. PANAMA, 191 specimens from: CANAL ZONE - Ancon; Barro Colorado Island; Cabima; Camp Chagres; Fort Kobbe; Madden Forest; Margarita; Paraiso; Pipeline Road; Rio Trinidad. CHIRIQUI PROV. - Bugaba, 800-1500 ft. COCLE PROV. - El Valle. COLON PROV. - Coco Solo; Portobelo; Santa Rita Ridge. PANAMA PROV. - Bayano Bridge; Cerro Campana. COLLECTION DATES: Every month of the year.

OTHER COUNTRIES, 32 specimens from: MEXICO, COSTA RICA, COLOMBIA, VENEZUELA.

REMARKS. This species has been obtained from Berlese separation of forest floor litter, from rotting fruit of _Gustavia_ sp., from carrion of agouti, rat, sloth, and tamandua, and from feces of horse, howler monkey, spider monkey, man, and tapir. It has also been taken perching on leaf surfaces. On Barro Colorado Island, _plebejus_ is diurnally active, particularly from 1100 to 1300 hours, and appears to be equally abundant in all months of the year. It does exhibit a seasonal shift in food utilization, however, occurring primarily on feces in the dry season and on carrion in the wet season.

In Panama _plebejus_ is seemingly restricted to lowland forest below 1000 m in elevation.

3. _Eurysternus velutinus_ Bates

Fig. 10

Eurysternus velutinus Bates, 1887, p. 39; Halffter and Halffter, 1978, p. 49.

Cotypes, London and Paris. Examined.

Length 17 to 22 mm. Dorsally brownish black; setae fine, numerous, similar in size on pronotum and elytron, less closely spaced on elytron. Pronotal surface except at midline evenly convex, midline in posterior fourth indented, in anterior fourth often feebly raised and shining; surface otherwise closely, shallowly ocellately punctate. Elytral striae represented by scarcely depressed, paired shining lines and obsolete punctures; elytral intervals dull, most with two to three irregular rows of fine setae. Metasternum with median area shallowly concave, more so posteriorly; lateral surface to edge of middle coxa minutely punctate, finely setose. Hind femur lacking posterior tooth (Fig. 10). Hind tibia feebly sinuate on ventral edge (in lateral view).

MATERIAL EXAMINED. PANAMA, 2 specimens from: CANAL ZONE - Madden Forest. CHIRIQUI PROV. - Volcan de Chiriqui, 2000-3000 ft. COLLECTION DATES: December.

OTHER COUNTRIES, 1 specimen from: ECUADOR.

REMARKS. This species has only been collected at human feces.

4. Eurysternus mexicanus Harold

Figs. 4, 11

Eurysternus mexicanus Harold, 1869b, p. 505.

Type or cotype, Paris. Not seen.

Length 11 to 14 mm. Dorsally very dark brown to black, frequently mottled with brown, more conspicuously so on head and pronotum; dorsal setae small. Pronotum indented at midline in posterior fourth, on either side anterior to indentation a smooth, feebly raised swelling extending obliquely toward lateral fovea; three small polished swellings present at anterior sixth, one on midline and a proximal one on each side; remainder of pronotum moderately punctate, setose. Elytral striae shallow, represented by a narrow double line, punctures obsolete. Posterior margin of prosternum (Fig. 4) nearly straight. Metasternum with smooth circular indentation medially, area dull. Fore femur abruptly angulate at basal ventral third. Hind femur (Fig. 11) with posterior tooth at distal third, distal half of femur swollen, somewhat oval. Hind tibia moderately arcuate, not sinuate.

MATERIAL EXAMINED. PANAMA, 65 specimens from: BOCAS DEL TORO PROV. - Almirante, Changuinola District. CANAL ZONE - Camp Chagres. COCLE PROV. - El Valle, Rio Guayabo. PANAMA PROV. - Cerro Campana. COLLECTION DATES: January, February, March, September, October.

OTHER COUNTRIES, 27 specimens from: MEXICO, NICARAGUA, COSTA RICA.

REMARKS. This species has been collected on horse manure and on human feces.

5. Eurysternus caribaeus (Herbst)

Figs. 3, 12

Scarabaeus caribaeus Herbst, 1789, p. 300.

Type, Berlin (?). Not seen.

Eurysternus caribaeus (Herbst), Halffter and Halffter, 1978, p. 57.

Length 14 to 18 mm. Dorsally brown mottled with black; setae inconspicuous except along lateral margins of pronotum and near elytral apices. Pronotum with numerous moderate punctures, surface not noticeably irregular; a distinct, shining, dark spot present on midline at anterior fourth. Elytral striae moderately indented, narrow; elytral disc longitudinally feebly concave laterally. Metasternum irregularly, shallowly impressed near midline, mostly dull. Prosternum (Fig. 3) with posterior margin medially obtusely angulate. Hind femur (Fig. 12) with posterior margin toothed near apical fourth in male, near middle in female. Hind tibia only moderately arcuate.

MATERIAL EXAMINED. PANAMA, 50 specimens from: CANAL ZONE - Barro Colorado Island; Madden Forest; Pipeline Road; Rio Trinidad. PANAMA PROV. - Bayano Bridge; Cerro Campana; Rio Pequeni. COLLECTION DATES: February, April, May, June, August, September, October, December.

OTHER COUNTRIES, 40 specimens from: MEXICO, COSTA RICA, COLOMBIA, ECUADOR.

REMARKS. Specimens have been obtained at rat, tamandua, toad, and unknown carrion, and on feces of coati, horse, man, howler monkey, spider monkey, and tapir. It is more common on carrion and on Barro Colorado Island is active at night. It is most abundant during the wet season. In Panama the species is restricted to lowland forests. Halffter and Halffter (1978) have discussed some aspects of the biology of caribaeus.

6. Eurysternus magnus Laporte

Fig. 13

Eurysternus magnus Laporte, 1840, p. 93.

Type, probably in Paris. Not seen.

Length 15 to 19 mm. Dorsally very dark brownish black, elytra mottled with brown; dorsal setae minute except near apices of elytra. Pronotum with surface dull, finely punctate; fairly evenly convex except for an irregular circle of six slightly raised, usually shining, small tumosities; two tumosities at anterior fourth, two more widely separated near posterior third, and two proximate ones near midline at posterior fourth. Elytral striae consisting of two slightly impressed shining lines. Metasternum with small central, dull depression; median surface posteriorly flat in females, cariniform in males. Hind femur (Fig. 13) with posterior margin toothed at apical third in both sexes. Hind tibia not sinuate, ventrally arcuate.

MATERIAL EXAMINED. PANAMA, 47 specimens from: BOCAS DEL TORO PROV. - Rio Changuinola, 5000 ft. CHIRIQUI PROV. - Baldwin Forest; Boquete; Cerro Punta (2 km E, 2200 m); Hartmann's Finca, 1200 m; Las Lagunas; Rio Chiriqui, 5600 ft.: Viejo, Volcan de Chiriqui, >4000 ft. COLLECTION DATES: January, February, March, May, June, August, September, October, November.

OTHER COUNTRIES, 12 specimens from: MEXICO, COSTA RICA.

REMARKS. Specimens have been collected at carrion and on human and horse dung. The species is active nocturnally and is restricted to forests above 900 m in elevation.

Megathoposoma Balthasar

Megathoposoma Balthasar, 1939a, p. 18; Halffter and Martínez, 1966, p. 141 (generic synonymy and detailed generic description).

Type-species: Megathopa candezei Harold, 1873, by monotypy.

Megathopa Eschscholtz, 1822, p. 34; Bates, 1887, p. 25; Howden, 1966, p. 726.

Body shape (Fig. 5) elongate-oval. Much of dorsum punctate, many punctures annular; glabrous. Head somewhat triangular in shape; clypeus closely bidentate, a transverse band of setae present dorsally on each tooth near base; head lacking tubercles or carina; eyes dorsally moderate in width, not narrowed posteriorly. Pronotum fairly evenly convex, lateral fovea small and circular; marginal bead lacking posteriorly. Scutellum small, acutely angled posteriorly. Elytra each with eight discal striae and an additional two lateral striae in anterior third below carinate eighth stria; each discal stria represented by impressed line with scattered elongate punctures; conspicuous, shining, nearly square black markings irregularly spaced along striae; intervals nearly flat, moderately punctate, the punctures separated by approximately one diameter. Pygidium feebly convex, closely punctate. Proepisternum and proepimeron not separated by carina. Mesosternum very narrow; middle coxae widely separated by metasternum.

This monotypic genus is restricted to Mexico and Central America.

1. *Megathoposoma candezei* (Harold)

Fig. 5

Megathopa candezei Harold, 1873, p. 102; Bates, 1887, p. 26.
Type, Paris. Not seen.
Megathoposoma deltochiloides Balthasar, 1939a, p. 19.
Megathoposoma candezei (Harold), Balthasar, 1942, p. 43; Halffter and Martínez, 1966, p. 150.

Length 18 to 24 mm; greatest width 11 to 13 mm. Dorsally with underlying black background, pronotum mottled cupreous and green, head nearly uniform cupreous, elytra cupreous or green with rows of squarish black markings (Fig. 5) along striae; pygidium cupreous. Legs and ventral surface mostly black, frequently with greenish cast. Fore tibia with three teeth on outer margin in apical third; tibial spur of male deeply emarginate, each half of bifurcation sharply acute and nearly as long as base below emargination. Middle tibia with small tooth on outer margin at apical third. Hind tibia not distinctly expanded near apex, slender; apex with single tibial spur. Ventral surfaces of femora closely punctate, most punctures each with minute seta.

MATERIAL EXAMINED. PANAMA, 1 specimen from: CHIRIQUI PROV.

OTHER COUNTRIES, 20 specimens from: MEXICO, GUATEMALA, NICARAGUA, COSTA RICA.

REMARKS. This species is easily recognized by its relatively elongate-oval shape, punctate dorsum with a greenish cast and elytra with rows of shining, almost square, black spots. It ranges from southern Mexico to Panama.

Wille (1973, 1974) has described the biology of *candezei* in some detail. The species has been taken outside of Panama in tropical forested areas in traps baited with human feces.

Canthon Hoffmannsegg

Canthon Hoffmannsegg, 1817, p. 38; Vulcano and Pereira, 1964 (Catalogue); Halffter and Martínez, 1977 (Revision).

Type-species: *Scarabaeus pilularius* Linnaeus, by subsequent designation, Paulian, 1938.

The genus *Canthon* Hoff. and its close relatives are currently under study by G. Halffter and A. Martínez. Recently *Canthon*, sensu lato, was divided into a number of genera and subgenera, and in some cases there are differences of opinion on the exact status - genus, subgenus or species group - desirable for some of the proposed divisions. Much of this should be resolved when Halffter and Martínez complete their studies. Since *Canthon* is still under revision we have decided to adopt a conservative approach - recognizing only *Pseudocanthon* and *Canthon* as distinct genera. Thus, for convenience, we have considered *Scybalocanthon*, *Glaphyrocanthon*, etc., as subgenera of *Canthon* and have not included them herein. Our key to species hopefully is adequate and placement of the species into groups can be determined by consulting Halffter and Martínez, 1977 (and subsequent work).

Canthon, as delimited here, can be recognized by the following combination of characters. Moderate size of 4.0 to 14.0 mm. Clypeus anteriorly emarginate or with two to four teeth. Frons and vertex lacking tubercles. Dorsal ocular areas delimited laterally by a nearly complete canthus. Posterior of vertex with complete, sometimes fine, marginal bead. Pronotum lacking marginal bead basally; lateral pronotal margins angular or arcuate, their basal portions not appearing subparallel when viewed from above; anterior angles quadrate or acute. Mesosternum short and transverse, usually more than 10 times as wide as long. Meso-metasternal suture evenly and very feebly arcuate. Elytron maximally with nine striae, these often obsolescent or lacking. Fore tibia obliquely truncate, with three outer teeth. Hind tibia slender, not noticeably expanded apically nor flattened near apex, nearly quadrate in cross section. Tarsal segments flattened, triangular or trapezoidal. Tarsal claws feebly to moderately curved, not dentate.

Key to species of *Canthon*

1. Hind femur ventrally with fine line or carina present adjacent to anterior edge 2
Hind femur ventrally lacking line or carina near anterior edge 11

2. Hind femur ventrally with fine line or carina adjacent to posterior edge 3
Hind femur ventrally lacking fine line or carina adjacent to posterior edge 5

3. Pygidium with basal carina present, average size 6 mm or more. 4
Pygidium lacking distinct basal carina; dorsal color greenish gold or green or bluish green; average size 5 mm . . . . 10. *morsei* group

4. Dorsal color not uniform, pronotum brown with black markings . . . . 7. *cyanellus sallei* Har. (in part)
Dorsal color uniformly black, sometimes with purple reflections . . . . 8. *aequinoctialis* Har.

5. Clypeus anteriorly bidentate 6
Clypeus anteriorly quadridentate 8

6. Dorsum lacking distinct setae; size over 6 mm . . 7
Dorsum with scattered, distinct setae; size under 6 mm; color dorsally black, usually with feeble metallic luster . . . . 9. *juvencus* Har.

7. Pygidium with basal carina present; color dorsally uniform, bluish black or green . . . . 4. *indigaceus chevrolati* Har.
Pygidium lacking basal carina; color dorsally black with yellow spots . . 2. *septemmaculatus* (Latr.)

8. Thorax ventrally with proepimeral carina incomplete (extending from coxa to thoracic margin) or absent; dorsally bicolored or pronotum mottled . 9
Thorax ventrally with proepimeral carina complete; color uniform, black with blue reflections . . . . 3. *deyrollei* Har.

9. Pronotum black, often with blue or green cast; size usually under 7 mm 10
Pronotum brown with black markings; size usually 7 mm or more. . 7. *cyanellus sallei* Har. (in part)

10. Two inner clypeal teeth V-shaped, distinctly widened basally; elytra and metasternum alutaceous, dull, brown and black. . . . . 5. *lituratus* (Germ.)
Two inner clypeal teeth very slender, elongate; elytra and metasternum smooth between punctures, shining brown and black . . . . . 6. *mutabilis* Lucas

11. Clypeus anteriorly quadridentate 12
Clypeus anteriorly bidentate 13

12. Thorax ventrally with proepimeral carina complete (extending from coxa to thoracic margin); at least head and pronotum black, often with bluish reflections . . . . 14. *femoralis* (Chev.)
Thorax ventrally with proepimeral carina incomplete or laterally obsolete; pronotum yellowish, elytra brown . . . . 11. *angustatus* Har.

13. Pygidium with basal carina; thorax ventrally with complete proepimeral carina 14
Pygidium lacking basal carina; thorax ventrally lacking proepimeral carina . . . 1. *moniliatus* Bates

14. Head and pronotum bluish to bluish black or black, elytra similar or reddish brown with black markings 15

Dorsally uniformly green, often with gold or metallic reflections (see also note on 15a. *caelius* Bates) . . . . 15. *lamprimus* Bates

15. Antero-lateral margin of prothorax with denticle on ventral edge; elytra smooth, shining 16
Antero-lateral margin of prothorax lacking denticle on ventral edge; elytra shagreened, dull . . . . 16. *viridis meridionalis* M., H., & H.

16. Elytra black with bluish reflections . . . . 13. *euryscelis* Bates
Elytra red-brown or brown, usually with black borders . . . . 12. *subhyalinus* Har.

1. *Canthon moniliatus* Bates

Figs. 6, 20, 21

Canthon moniliatus Bates, 1887, p. 27.

Cotypes, London and Paris. London specimens examined.

Length 6.0 to 8.0 mm. Dorsally moderately shining, head and elytra of varying shades of brown, head usually darker. Pronotum yellowish, medially at basal margin with blackish marking, occasionally with larger black marking medially near anterior margin. Pygidium brown, approximately same shade as elytron. Clypeus (Fig. 20) anteriorly bidentate. Gena laterally at clypeal junction feebly produced, very slightly obtusely angled; eye dorsally approximately three times as long as wide. Pronotum (Fig. 6) with anterior lateral margin straight, ventral edge lacking a tubercle. Elytron with eight discal striae represented by shallowly indented lines, each stria with relatively large, shallow punctures separated from adjacent punctures by approximately one diameter; intervals smooth, impunctate. Pygidium with basal carina absent, pygidial surface smooth, dull, shagreened. Antenna brown, club grey. Prosternum with proepimeral carina absent. Metasternum between coxae smooth and shining. Fore tibia (Fig. 21) similar for both sexes, spur slender, apex acute. Hind femur ventrally lacking lines adjacent to margins.

MATERIAL EXAMINED. PANAMA, 249 specimens from: CANAL ZONE - Barro Colorado Island; Coco Solo; Madden Forest; Pipeline Road; Rio Ciricito. PANAMA PROV. - Bayano Bridge (9 km SE); Cerro Campana. COLLECTION DATES: Every month of the year.

OTHER COUNTRIES, 19 specimens from: COSTA RICA.

REMARKS. *Canthon moniliatus* has been collected flying; in leaf litter and sitting on leaf surfaces; on fallen *Entada* sp. pods covered with white fungi and on Agaricaceae fungi; at opossum, peccary, rat, snake, and sloth carrion; and on howler monkey, human, jaguarundi, tapir, and rodent feces.

On Barro Colorado Island, this species is equally abundant at any time during the day. Although the species is relatively uncommon, both teneral and mature adults occur throughout the year. *Canthon moniliatus* (as well as *Onthophagus sharpi*) utilizes the widest range of food types of the 56 species of Scarabaeinae found on Barro Colorado Island. It is one of only six species that is found at carrion in the dry season and one of four species found on fungi at any time. It does not aggregate in the manner of *C. angustatus*. Usually only one or two individuals are found at one time on the same food source. Panamanian specimens of *moniliatus* are found only in lowland moist forests, usually below 200 m.

2. *Canthon septemmaculatus* (Latreille)

Figs. 22, 23

Ateuchus septemmaculatus Latreille, 1811, p. 180.
Type, Paris. Not seen.
Canthon septemmaculatus (Latr.); Harold, 1868, p. 51.

Length 8.5 to 12.0 mm. Dorsally dull; head greenish black, pronotum, elytra and pygidium very dark brown to black; pronotum with five yellowish spots, a spot adjacent to each pronotal angle and one posterior median spot; two additional yellowish spots in basal half of pygidium, one on either side of midline. Clypeus (Fig. 22) anteriorly bidentate. Margin of gena adjacent to clypeus very obtusely angulate, only feebly produced; eye dorsally moderate in size, approximately three times as long as wide. Pronotum with antero-lateral margin nearly straight, ventral edge lacking tubercle. Elytron with all but marginal stria obsolete. Pygidium with basal carina absent; pygidial surface dull, finely granular. Antenna dark brown to black. Prosternum lacking proepimeral carina. Metasternum between coxae feebly shining, surface very finely granular or shagreened. Fore tibia (Fig. 23) of male with spur scarcely expanded apically, shallowly cleft; spur of female slender and acute at apex. Hind femur ventrally with only anterior line present adjacent to margin.

MATERIAL EXAMINED. PANAMA, 182 specimens from: CANAL ZONE - Barro Colorado Island; Coco Solo; Corozal; Curundu; Farfan; Fort Clayton; Fort Davis; Fort Kobbe; Frijoles; Gamboa; Madden Dam; Margarita; Pedro Miguel; Pipeline Road; Rodman; Summit Park; Tabernilla. COCLE PROV. - Aguadulce; El Valle. COLON PROV. - Santa Rita Ridge. LOS SANTOS PROV. - Tonosi. PANAMA PROV. - Arraijan: Camp Chagres; Cerro Azul; Cerro Campana; Cermeno; Panama City; Punta Vacamonte. COLLECTION DATES: Every month of the year except February.

OTHER COUNTRIES, 17 specimens from: COLOMBIA, VENEZUELA.

REMARKS. This species has been found sitting on leaf surfaces; at rat carrion; and on feces of coati, dog, horse, howler monkey, and man. On Barro Colorado Island *septemmaculatus* is active throughout the day, primarily in the wet season. In the early wet season it is most abundant on feces but by the late wet season is most abundant on carrion. It is one of the few species of Scarabaeinae able to successfully and routinely pirate food balls from other ball-rolling scarabs. The species apparently is moderately eurytopic, occurring in moist and dry forest, forest-pasture ecotones, shrub-land, and in small cleared areas in the preceding habitats. It is mainly limited, however, to areas below

1000 m in elevation.

3. Canthon deyrollei Harold

Figs. 24, 25

Canthon deyrollei Harold, 1868, p. 132.

Type or cotype, Paris. Not seen.

Length 8.5 to 12.0 mm. Dorsally shining black, usually with blue or purple reflections. Clypeus (Fig. 24) anteriorly quadridentate, surface granulate. Gena laterally at clypeal junction obtusely angled forming small tubercle; eye dorsally moderate, approximately three times as long as wide. Pronotum with antero-lateral margin slightly arcuate, ventral edge with small tubercle. Elytron with discal striae marked by fine indented lines, intervals between mostly smooth. Pydigium with basal carina complete, pygidial surface smooth, very finely shagreened. Antenna black. Prosternum with proepimeral carina complete. Metasternum between coxae mostly smooth and shining. Fore tibia (Fig. 25) of male with spur widened and outwardly bent at middle, thence tapered to rounded apex; spur of female similar to that of male, more slender and with apex acute. Hind femur ventrally with line present adjacent to anterior margin, posterior line absent.

MATERIAL EXAMINED. PANAMA, None. Listed by Vulcano and Pereira (1964) as occurring in Central America and Colombia.

OTHER COUNTRIES, 8 specimens from: BELIZE, EL SALVADOR, NICARAGUA, COSTA RICA, COLOMBIA.

REMARKS. Seemingly a rare species that should occur in Panama.

4. Canthon indigaceus chevrolati Harold

Figs. 26, 27

Canthon chevrolati Harold, 1868, p. 119.

Type or cotype, Paris. Not seen.

Canthon indigaceous chevrolati Harold; Halffter, 1961, p. 288.

Length 7.5 to 11.0 mm. Dorsally pronotum and elytra shining, head and pygidium dull to feebly shining. Color ranging from bright green to bluish black. Clypeus (Fig. 26) anteriorly bidentate. Gena laterally at clypeal junction scarcely or not produced; eye moderate, approximately three times longer than wide. Pronotum with antero-lateral margin slightly outwardly arcuate, ventral edge usually lacking tubercle; if tubercle present then near anterior angle. Elytron with discal striae obsolete. Pygidium with basal carina complete, pygidial surface smooth, dull, very finely shagreened. Antenna black or brownish black. Prosternum with proepimeral carina absent or present only in basal fourth adjacent to coxae. Metasternum between coxae smooth, feebly shining, finely shagreened. Fore tibia (Fig. 27) of male with spur gradually expanded to moderately notched apex; spur of female slender, acute to abruptly rounded at apex. Hind femur ventrally with well defined line present adjacent to anterior margin, posterior line absent.

MATERIAL EXAMINED. PANAMA, 1 specimen from: CANAL ZONE - Pipeline Road. COLLECTION DATES: July.

OTHER COUNTRIES, 169 specimens from: MEXICO, EL SALVADOR, COSTA RICA.

REMARKS. The species has been taken in horse and cow dung and in traps baited with human feces.

5. Canthon lituratus (Germar)

Figs. 7, 28, 29

Ateuchus lituratus Germar, 1813, p. 117.
Type, Berlin. Not seen.
Canthon quadripustulatus Guérin, 1855, p. 587.
Type, location uncertain.
Canthon lituratus (Germar); Harold, 1868. p. 95.
Canthon lituratus quadripustulatus (Guérin); Bates, 1887, p. 33
(Bates considered that var. quadripustulatus included
Panama specimens).

Length 4.5 to 6.5 mm. Dorsally head and pronotum shining green; elytra dull, black mottled with brown or with brown spots near humeri and apices; pygidium dull, very dark brown to black, sometimes with metallic sheen. Clypeus (Figs. 7, 28) anteriorly strongly quadridentate, inner teeth broadly V-shaped. Gena laterally near clypeal junction produced so that side of gena behind lobe or angle is nearly parallel to that of opposite gena; eye dorsally narrow, approximately four times as long as wide. Pronotum with antero-lateral margin straight or feebly arcuate, edge ventrally lacking tubercle; pronotal surface with numerous small punctures, area between finely shagreened. Elytron with all striae except marginal one feebly indicated by vague lines; intervals flat, distinctly granulate. Pygidium with basal carina complete; pygidial surface granulate, with scattered small shining spots. Antenna, particularly club, tan. Prosternum with proepimeral carina incomplete, present only in fourth adjacent to coxa. Metasternum between coxae only moderately shining, finely granular, moderately punctate, most punctures (in clean unworn specimens) with a minute seta. Fore tibia (Fig. 29) with apical spur long and slender, similar in both sexes. Hind femur ventrally with line adjacent to anterior margin present, posterior line lacking.

MATERIAL EXAMINED. PANAMA, 41 specimens from: CHIRIQUI PROV. - Galera de Chorcha; Rovira; Volcan de Chiriqui. COCLE PROV. - Aguadulce. COLLECTION DATES: February, July, September.

OTHER COUNTRIES, 50 specimens from: COLOMBIA, VENEZUELA.

REMARKS. This species has been recorded only from dog feces. It appears to be restricted in Panama to elevations above 800 m.

6. *Canthon mutabilis* Lucas

Figs. 30, 31

Canthon mutabile Lucas, 1857, p. 100.
Type, Paris (?). Not seen.
Canthon mutabilis Lucas; Harold, 1868, p. 126.
Canthon mutabilis transversalis Harold, 1868, p. 126 (close to Panama form according to Bates, but Harold's "variety a" describes the elytral pattern better. Schmidt, 1922, named a number of forms of *mutabilis*; however these have not been listed as valid subspecies by Halffter and Martínez, 1977).

Length 5.0 to 6.5 mm. Dorsally shining; head and pronotum green, pronotum sometimes with brownish cast along lateral margins; surface of head and pronotum with distinctly separated, small punctures; elytra reddish brown, the sutural intervals and a transverse band at apical third black or elytral disc black with margins reddish brown; pygidium black with greenish cast. Clypeus (Fig. 30) anteriorly quadridentate, the inner teeth slender. Gena laterally adjacent to clypeus briefly, angulately produced; eye dorsally narrow, approximately four times as long as wide. Pronotum with antero-lateral margin slightly angulate between pronounced anterior and median lateral angles, ventral edge with small tubercle beneath slight angulation. Elytron with nine striae, the eight discal striae represented by five slightly indented lines; intervals minutely punctate. Pygidium with basal carina complete, pygidial surface dull, granular. Antenna, particularly club, tan. Prosternum with proepimeral carina incomplete, approximately half of carina present. Metasternum between coxae shining, surface with numerous small punctures. Fore tibia (Fig. 31) with apical spur acutely tapered in both sexes, base of spur slightly broader in male. Hind femur ventrally with anterior line present adjacent to margin, posterior line absent.

MATERIAL EXAMINED. PANAMA, 12 specimens from: CANAL ZONE - Ancon; Barro Colorado Island; Coco Solo; Corozal. CHIRIQUI PROV. - Guabala. COCLE PROV. - Aguadulce. LOS SANTOS PROV. - Cerro La Venta. PANAMA PROV. - La Chorrera. COLLECTION DATES: February, May, June, August, September, December.

OTHER COUNTRIES, 27 specimens from: COLOMBIA, VENEZUELA, BRAZIL, ARGENTINA.

REMARKS. *Canthon mutabilis* has been recorded from dung and taken sitting on leaf surfaces in lowland forests.

7. *Canthon cyanellus sallei* Harold

Figs. 32, 33

Canthon sallei Harold, 1863, p. 174.
Cotypes, London and Paris. London specimens examined.
Canthon sallei triangulatus Schmidt, 1920, p. 124 (a Panamanian-Costa Rican color form).
Canthon cyanellus sallei Harold; Halffter and Martínez, 1977, p. 90.

Length 6.0 to 9.0 mm. Color dorsally variable; head black usually with greenish cast, pronotum yellowish to tan with margins and midline at center blackish; elytra tan to brown to dark brown with margins sometimes black; pygidium yellowish often with dark apical spot (this type of coloration typical of the variety *triangulatus* found in Panama and Costa Rica). Clypeus (Fig. 32) anteriorly quadridentate. Gena feebly produced or dentate adjacent to clypeal junction; eye narrow, three or more times longer than wide. Pronotum with antero-lateral margin straight or feebly arcuate, ventral edge lacking tubercle. Elytron with nine striae, all but lateral stria obsolete. Pygidium with fine basal carina complete, pygidial surface finely shagreened, dull. Antenna tan. Prosternum with proepimeral carina indicated only near coxa or absent. Metasternum between coxae minutely punctate, surface mostly shining. Fore tibia (Fig. 33) with spur of male not greatly expanded, apex shallowly notched, female spur slender, acute tip bent downward. Hind femur ventrally with fine line present near anterior margin; posterior line present in male, absent or only feebly indicated in female.

MATERIAL EXAMINED. PANAMA, 145 specimens from: BOCAS DEL TORO PROV. - Almirante; Changuinola District. CANAL ZONE - Barro Colorado Island; Canoa Saddles; Corozal; Curundu; Fort Kobbe; Frijoles (6 km NNW); Madden Forest; Pipeline Road; Rio Trinidad; Skunk Hollow; Summit Park. COLON PROV. - Alhajuela. DARIEN PROV. - Santa Fe. PANAMA PROV. - Juan Mina; La Campana. COLLECTION DATES: January, February, April, May, June, July, August, September, October, November, December.

OTHER COUNTRIES, 93 specimens from: MEXICO, NICARAGUA, COSTA RICA, COLOMBIA, ECUADOR, PERU, TRINIDAD.

REMARKS. *Canthon c. sallei* has been collected in forest leaf litter; flying; at human and tapir feces; on agouti, peccary, rat, and sloth carrion; at a refuse heap of *Eciton burchelli*; and on the carcasses of wood roaches and passalids. This species is active throughout the day on Barro Colorado Island, where it is the only Scarabaeinae to search for odor trails (and food) by flying low over the forest floor for extended periods of time (up to 15 minutes). Other species use various modifications of the sit-and-wait technique for food detection. *C. sallei* is primarily a carrion consumer, only rarely occurring on fecal material. It is restricted to the wet season, with worn and damaged specimens very rarely occurring in the dry season. In Panama *c. sallei* is found in lowland moist forest, usually below 200 m elevation.

8. *Canthon aequinoctialis* Harold

Figs. 34, 35, 36, 37

Canthon aequinoctialis Harold, 1868, p. 79.

Type, Paris. Not seen.

Length 10 to 13 mm. Color dorsally shining black, occasionally with purple reflections. Clypeus (Figs. 34, 36) anteriorly bidentate. Gena laterally at clypeal junction obtusely angulate, appearing feebly toothed; eye dorsally relatively wide, approximately twice as long as wide. Pronotum with antero-lateral margin nearly straight, ventral edge lacking distinct tubercle. Elytron with nine striae, all but lateral stria obsolete. Pygidium with basal carina complete, pygidial surface smooth and shining, impunctate. Antenna reddish or reddish tan. Prosternum with proepimeral carina complete. Metasternum between coxae smooth and shining. Fore tibia (Figs. 35, 37) with spur greatly expanded apically in male; spur slender and acute apically in female. Hind femur ventrally with both an anterior and a posterior line adjacent to respective margin.

MATERIAL EXAMINED. PANAMA, 500 specimens from: CANAL ZONE - Barro Colorado Island; Fort Kobbe; Madden Forest; Pipeline Road; Rio Chagres. CHIRIQUI PROV. - Progresso. COLON PROV. - Santa Rita Ridge. COLLECTION DATES: Every month of the year.

OTHER COUNTRIES, 64 specimens from: BELIZE, COSTA RICA, COLOMBIA (Amazonas).

REMARKS. *Canthon aequinoctialis* has been collected from leaf litter; in light traps; at agouti, peccary, and rat carrion; and at coati, human, jaguarundi, and tapir feces.

Of the 16 species of *Canthon* occurring in Panama, this is the only one that is nocturnally active, and on Barro Colorado Island is most active during the period from 1700 to 2100 hours. Reproductive activity may occur throughout the year on Barro Colorado Island, as both teneral and mature adults have been obtained in every month of the year. This species is one of the most abundant Scarabaeinae on Barro Colorado Island and appears to have a stable population density during the entire year. During the wet season it is equally abundant on carrion and dung, but is found only on dung in the dry season. The species occurs primarily in lowland wet forests.

9. *Canthon juvencus* Harold

Figs. 16, 17, 38, 39

Canthon juvencus Harold, 1868, p. 111; Halffter and Martínez, 1977, p. 90.

Type or cotype, Paris. Not seen.

Canthon raripilis Bates, 1887, p. 30.

Cotypes, London and Paris. Examined.

Length 3.0 to 4.5 mm. Dorsally black, occasionally with cupreous or metallic reflections; surface of head, pronotum and elytra with scattered distinct punctures, each puncture with an erect pale seta. Clypeus (Figs. 16, 17, 38) anteriorly bidentate. Gena laterally at clypeal junction slightly produced, obtusely angled. Eye dorsally approximately three times as long as wide. Pronotum with antero-lateral margin nearly straight except at middle, there margin offset by small ventral tubercle. Elytron with all but marginal stria obsolete. Pygidium with basal carina complete, pygidial surface finely shagreened with scattered setose punctures being more pronounced near apex. Antenna dark brown, club greyish brown. Prosternum with proepimeral carina complete.

Metasternum between coxae shining, the surface with scattered punctures, usually each puncture with minute seta. Fore tibia (Fig. 39) with spur of male of uniform width to apex, apex notched; slender and tapered to acute apex in female. Hind femur ventrally with line adjacent to anterior margin present, posterior line absent.

MATERIAL EXAMINED. PANAMA, 20 specimens from: CANAL ZONE - Barro Colorado Island; Coco Solo; Fort Kobbe; France Field; Madden Forest; Pipeline Road. COLON PROV. - Santa Rita Ridge. PANAMA PROV. - Pearl Islands; Taboga Island. COLLECTION DATES: January, April, May, June, December.

OTHER COUNTRIES, 12 specimens from: COLOMBIA, VENEZUELA, BRAZIL.

REMARKS. This species has only been recorded from human feces. _Canthon juvencus_ is active diurnally and occurs at the beginning and end of the wet season in lowland forests.

10. _Canthon morsei_ group (Panama form)

Figs. 14, 15, 40, 41

Canthon morsei Howden, 1966, p. 728; group currently under study by Halffter and Martínez.

Type, Ottawa. Examined.

Length 4.5 to 6.0 mm. Color dorsally shining green, frequently with golden reflections, occasional specimens black with blue reflections; pronotum and elytra minutely punctate, surface of head finely punctate, the punctures at least twice the size of those on pronotum. Clypeus (Figs. 14, 40) anteriorly bidentate. Gena laterally at clypeal junction feebly produced, obtusely angulate; eye dorsally relatively narrow, approximately four times as long as wide. Pronotum with antero-lateral margin nearly straight, slightly inwardly arcuate posteriorly, small tubercle usually present at middle of ventral edge. Elytron with eight moderately distinct discal striae, each stria slightly but distinctly impressed, the impression shagreened and with occasional widely spaced punctures; intervals between striae shining, surface mainly smooth, minutely punctate. Pygidium lacking distinct basal carina (in this respect differing from Mexican _morsei_), pygidial surface dull, shagreened; shallowly, closely punctate. Antenna brown to greyish brown. Prosternum with proepimeral carina present only on inner half adjacent to coxae. Metasternum between coxae feebly shining, finely shagreened and minutely punctate. Fore tibia (Fig. 41) with spur of uniform width to narrowly notched apex, spur of female slender and acute at apex. Hind femur ventrally with both anterior and posterior line present adjacent to respective margin. Male genitalia as in fig. 15.

MATERIAL EXAMINED. PANAMA, 40 specimens from: CANAL ZONE - Barro Colorado Island; Gamboa (1 mile S); Madden Forest. CHIRIQUI PROV. - Hartmann's Finca. COLLECTION DATES: May, June, July, September.

OTHER COUNTRIES, 15 specimens from: MEXICO, EL SALVADOR, ECUADOR.

REMARKS. This species has been captured at carrion and on human feces. Canthon morsei is active diurnally, occurs only in the wet season and is found in moist forest over a broad range of elevations.

11. Canthon angustatus Harold

Figs. 42, 43

Canthon angustatus Harold, 1867a, p. 79.

Type, Paris. Not seen.

Length 4.5 to 6.5 mm. Dorsally shining; head and pronotum largely yellowish tan to reddish brown with margins darker, often nearly black; pronotum with median black marking present at anterior and posterior margins, the small elongate anterior marking occasionally obsolete; larger posterior marking always present, often hastiform; elytra dark reddish brown, often semitransparent with metathoracic wings vaguely visible. Legs usually yellowish, apices and bases of femora and tibiae blackish. Clypeus (Fig. 42) anteriorly quadridentate, gena not produced at clypeal junction; eye moderate in size, approximately 2 1/2 times as long as wide. Pronotum with antero-lateral margin irregular; small tubercle present on margin in unworn specimens. Elytron with discal striae represented only by extremely faint lines. Pygidium with fine basal carina complete, surface finely shagreened, dull. Antenna with club yellowish brown. Prosternum with proepimeral carina incomplete, the carina broken in lateral fifth. Metasternum between coxae shining, very finely closely punctate. Fore tibia (Fig. 43) with spur of male apically cleft; tibia moderately expanded, elongate; spur of female acute apically, very feebly sinuous. Hind femur ventrally lacking anterior and posterior lines.

MATERIAL EXAMINED. PANAMA, 320 specimens from: CANAL ZONE - Barro Colorado Island; Fort San Lorenzo; Pipeline Road. COLON PROV. - Alhajuela. COLLECTION DATES: Every month of the year.

OTHER COUNTRIES, 191 specimens from: BELIZE, NICARAGUA, COSTA RICA, ECUADOR, PERU.

REMARKS. This species has been collected sitting on leaf surfaces and at howler monkey and human feces. One specimen bears an "at light" label. Canthon angustatus is active diurnally, and on Barro Colorado Island is most active during the periods from 0600 to 1000 hours and from 1500 to 1800 hours. These intervals coincide with the defecation periods of the howler monkey, the feces of which angustatus appears to prefer. This species is the most abundant scarabaeine on Barro Colorado Island, with high population levels maintained in all months of the year. Teneral adults also occur throughout the year, suggesting continuous reproductive activity.

This is one of only two species of Scarabaeinae (the other is Canthon subhyalinus) that occurs in the forest canopy ($>$ 20 m), where individuals form and roll primate feces that is adhering to leaf surfaces. The beetle remains attached to the ball as it falls to the ground, landing on top of the ball. Once on the ground the beetle reshapes the fecal material into a ball and then rolls it away. The species is known to occur only in lowland moist forest areas where howler monkeys are found.

12. *Canthon subhyalinus* Harold

Figs. 44, 45

Canthon subhyalinus Harold, 1867a, p. 79; Halffter and Martínez, 1977, p. 80.

Type or cotype, Paris. Not seen.

Length 4.5 to 5.5 mm. Dorsally with head, pronotum, base and suture of elytra, and pygidium, shining black. Disc of each elytron translucent tan to reddish brown, the folded metathoracic wings often partly visible through elytron. Clypeus (Fig. 44) anteriorly bidentate. Gena laterally at clypeal junction with margin continuous with that of clypeus or very slightly produced; eye dorsally approximately three times as long as wide. Pronotum with antero-lateral margin interrupted at middle by ventral tubercle, the margin anterior to tubercle straight, posteriorly from tubercle to median angle inwardly arcuate. Elytron with discal striae obsolete or absent. Pygidium with basal carina complete, pygidial surface finely transversely shagreened. Antenna brown. Prosternum with proepimeral carina complete. Metasternum between coxae shining, mostly smooth with scattered minute punctures. Fore tibia (Fig. 45) with spur in male expanded to unevenly divided apex, one lobe of division slender and sharply acute, the other lobe four or more times as broad, tapered abruptly and often irregularly to sharp apex. Spur of female slender, tapering to acute apex. Hind femur ventrally lacking lines adjacent to margins.

MATERIAL EXAMINED. PANAMA, 106 specimens from: CANAL ZONE - Barro Colorado Island; Rio Trinidad; Road to La Pita. DARIEN PROV. - Santa Fe. COLLECTION DATES: January, February, March, April, May, June, July, September.

OTHER COUNTRIES, 28 specimens from: MEXICO, COSTA RICA, COLOMBIA, PERU.

REMARKS. This species has been found in forest leaf litter and perching on leaf surfaces; and at howler monkey, human, jaguarundi, and tapir feces. *Canthon subhyalinus* is diurnally active on Barro Colorado Island and, like *angustatus*, is particularly active during the periods of 0600 to 1000 hours and 1500 to 1800 hours. This species also seems to prefer howler monkey feces and is only rarely found on other fecal material. Competition with *angustatus* appears to be reduced, however, by a preference of *subhyalinus* for flat terrain with a high canopy, areas in which *angustatus* occurs in relatively low densities. *C. subhyalinus* can also obtain primate fecal material adhering to leaf surfaces in the forest canopy. Most teneral and mature adults occur in the dry season, with only worn and damaged individuals appearing in the mid to late wet season. The preferred habitat is level lowland moist forest.

13. Canthon euryscelis Bates

Figs. 46, 47

Canthon euryscelis Bates, 1887, p. 28; Halffter and Martínez, 1977, p. 79-80.

Cotypes, London and Paris. London specimens examined.

Length 3.8 to 5.2 mm. Dorsally with head and pygidium feebly shining or dull (granular), pronotum and elytra smooth and shining; uniformly black with bluish reflections. Clypeus (Fig. 46) anteriorly bidentate. Gena laterally at clypeal junction feebly, obtusely angulate; eye dorsally approximately three times as long as wide. Pronotum with antero-lateral margin sinuate, ventral edge with tubercle. Elytron smooth, striae obsolete except for lateral one. Pygidium with fine, complete basal carina; pygidial surface shagreened and minutely punctate. Antenna brown to tan. Prosternum with proepimeral carina complete. Metasternum between coxae shagreened and very minutely punctate. Fore tibia (Fig. 47) with spur of male slightly expanded apically, shallowly notched; spur of female tapered to acute apex. Hind femur ventrally lacking lines adjacent to margins.

MATERIAL EXAMINED. PANAMA, 1 specimen from: CHIRIQUI PROV. - Bugaba.

OTHER COUNTRIES, 12 specimens from: MEXICO, BELIZE, GUATEMALA, COSTA RICA.

REMARKS. Some of the non-Panamanian specimens were taken in pit-fall traps baited with human feces.

14. Canthon femoralis (Chevrolat)

Figs. 48, 49

Caprobius femoralis Chevrolat, 1834, p. 110.

Type or cotype, London. Examined.

Canthon femoralis (Chevrolat); Harold, 1868, p. 62.

Length 7.0 to 8.5 mm. Dorsally shining black with bluish reflections, elytra frequently partially brown, particularly near apices. Clypeus (Fig. 48) anteriorly quadridentate. Gena laterally at clypeal junction not notched or produced, the margin continuous with clypeus; eye dorsally relatively wide, approximately 2 to 2 1/2 times as long as wide. Pronotum with antero-lateral margin inwardly arcuate behind tubercle on ventral edge. Elytron with discal striae obsolete. Pygidium with basal carina complete, pygidial surface feebly shining, finely shagreened and occasionally with minute punctures. Antenna brown, club greyish brown. Prosternum with proepimeral carina complete. Metasternum between coxae smooth and shining. Fore tibia (Fig. 49) with spur of male slightly expanded to notched apex, spur of female slender, apex acute. Hind femur ventrally lacking lines adjacent to margins.

MATERIAL EXAMINED. PANAMA, None.

OTHER COUNTRIES, 54 specimens from: MEXICO, GUATEMALA, COSTA RICA, COLOMBIA, ECUADOR.

REMARKS. Specimens from outside Panama have been collected during the day flying to human feces. Since the species has been taken in countries on either side of Panama, there is a distinct possibility that it will also be found in Panama.

15. Canthon lamprimus Bates

Figs. 50, 51

Canthon lamprimus Bates, 1887, p. 29; Halffter and Martínez, 1977, p. 80.

Cotypes, London and Paris. London specimens examined.

Length 4.0 to 5.5 mm. Dorsally shining green, often with golden reflections; all dorsal surfaces often with scattered minute punctures. Clypeus (Fig. 50) anteriorly bidentate. Gena laterally at clypeal junction slightly produced, obtusely angled; eye dorsally approximately three times as long as wide. Pronotum with anterolateral margin interrupted at middle by ventral tubercle, the margin anterior to tubercle straight, posteriorly to median angle inwardly arcuate. Elytron with all but lateral stria obsolete or absent. Pygidium with basal carina complete, pygidial surface dull, closely shagreened. Antenna brown, club grey. Prosternum with proepimeral carina complete. Metasternum between coxae shining, smooth except for scattered minute punctures. Fore tibia (Fig. 51) with spur gradually expanded to apex, apex moderately notched; spur of female tapered to acute apex. Hind femur ventrally lacking distinct lines adjacent to margins.

MATERIAL EXAMINED. PANAMA, 225 specimens from: CANAL ZONE - Ancon; Barro Colorado Island; Coco Solo; Fort Kobbe; Frijoles; Madden Forest; Margarita (4 km NE); Paraiso; Pipeline Road; Rio Ciricito; Rio Trinidad; Skunk Hollow. COCLE PROV. - El Valle (Las Minas Trail, 2400 ft.). COLON PROV. - Alhajuela; Santa Rita Ridge. PANAMA PROV. - Arraijan; Cerro Azul, 700 m; Cerro Campana. COLLECTION DATES: January, February, March, April, May, June, July, September, October, November, December.

OTHER COUNTRIES, No records.

REMARKS. Canthon lamprimus has been found sitting on leaf surfaces; at mouse, peccary, rat, tamandua, and snake carrion; and from coati, howler monkey, human, margay, and tapir feces.

This species on Barro Colorado Island is active throughout the day and is most abundant during the dry season. Teneral adults occur only in the dry season and adults captured in the mid - wet season or later are very worn. Canthon lamprimus is one of only six species of Scarabaeinae that occur on carrion in the dry season, whereas it is one of 24 species that utilizes carrion in the wet season. Its primary food in both seasons, however, appears to be vertebrate feces. Although this species has been collected at elevations of 700 to 900 m, it occurs primarily in lowland moist forest.

15a. Canthon caelius Bates

Canthon caelius Bates, 1887, p. 29 (possibly = lamprimus Bates).

Type, London. Examined.

Bates described this species from a unique female. No subsequent material assignable to this species has been discovered to the authors' knowledge. There are three possibilities: 1, caelius is a rare species or one occupying some unusual niche; 2, the specimen described as caelius is a very atypical example of lamprimus; 3, specimens that we have assigned to morsei should be called caelius, but if so Bates' description of the bicarinate hind tibia is incorrect which seems unlikely.

Halffter and Martínez (1977) have been the most recent investigators to examine the type and they relate it to lamprimus, separating it as follows:

Color and microsculpture equal on the pronotum and elytra; green with copper reflections; legs brown . lamprimus Bates
Pronotum brilliant green; elytra subopaque, bluish black; tibia and tarsi dull brown, ventral surface of femora with metallic green reflections . . . . caelius Bates

In addition to the above differences, Bates mentions that caelius has a more distinctly punctured pronotum. Unfortunately the size and density of the pronotal punctures, the color, etc., all vary in the series of lamprimus we have examined and we suspect that the name caelius is based on an atypical lamprimus. It is for this reason that we have not included it in the key or included a more formal description.

16. Canthon viridis meridionalis (Martínez, Halffter and Halffter)

Figs. 52, 53

Glaphyrocanthon viridis meridionalis Martínez, Halffter and Halffter, 1964, p. 32.
Canthon viridis meridionalis (M., H. & H.); Halffter and Martínez, 1977, p. 80.

Type, Washington. Examined.

Length 5.0 to 5.5 mm. Dorsally dull, finely granulate; dark blue to bluish black. Clypeus (Fig. 52) anteriorly bidentate. Gena laterally at clypeal junction obtusely angulate, appearing feebly toothed; eye dorsally approximately three times as long as wide. Pronotum with antero-lateral margin slightly inwardly arcuate, ventral edge lacking distinct tubercle. Elytron with discal striae obsolete, indicated by faint depressions. Pygidium with basal carina complete; pygidial surface dull, granular. Antenna brown to dark brown. Prosternum with proepimeral carina complete. Metasternum between coxae feebly shining, finely granular. Fore tibia (Fig. 53) with inner margin sinuate near middle, spur of male expanded and slightly cleft apically, spur of female sinuously tapered. Hind femur ventrally lacking lines near margins.

MATERIAL EXAMINED. PANAMA, 10 specimens from: CANAL ZONE - Ancon; Barro Colorado Island ; Pipeline Road; Tabernilla. PANAMA PROV. - Bella Vista; Cerro Azul. COLLECTION DATES: April, May, June, July.

OTHER COUNTRIES, 3 specimens from: EL SALVADOR, NICARAGUA, COSTA RICA.

REMARKS. This species has been collected sitting on leaf surfaces, from a rotting log, from carrion, and from human and tapir feces. Canthon viridis meridionalis is diurnally active, occurs during the early wet season, and is found in moist forest below 1000 m in elevation.

Pseudocanthon Bates

Pseudocanthon Bates, 1887, p. 35; Matthews, 1966, p. 83.

Type-species: *Canthon perplexus* LeConte, by monotypy.

The following combination of characters will separate this genus from related genera in the Canthonina (Halffter and Martínez, 1977): size small, length less than 6 mm; clypeus quadridentate; eye dorsally large; vertex with hind edge unmargined; pronotum parallel sided or nearly so in basal two-thirds; excavated propleura with proepimeral carina complete; elytra with scattered minute setae, stria 7 obsolete anteriorly, stria 8 obsolete posteriorly; fore tibia with inner apex sharply angulate.

This is a small genus containing nine species, most of which are Antillean. One species occurs in Panama.

1. *Pseudocanthon perplexus* (LeConte)

Figs. 18, 19

Canthon perplexus LeConte, 1847, p. 85.

Type, Cambridge. Not seen.

Length 3.8 to 5.0 mm, greatest width 2.5 to 3.0 mm. Oblong-oval (Fig. 18), black, shiny, legs rufous. Head (Fig. 19) finely alutaceous with dense, shallow punctures. Dorsal portion of eye twice as long as wide. Pronotum with shallow, dense, evenly distributed punctures; areas between punctures smooth. Elytral striae distinct, impunctate and superficial; intervals flat, smooth, with scattered, very short, sparse setae. Pygidium without transverse basal carina, shallowly punctate. Median lobe of metasternum densely punctate. Last abdominal sternite shortened medially in male, sternite of female not shortened medially. Fore tibia with three prominent teeth on outer margin, proximal tooth somewhat reduced and separated from distal pair; fore tibial spur of male spatulate, bifurcate apically; fore tibial spur of female tapering to acute apex, reflexed toward outer margin of tibia; hind femur margined on anterior border of ventral surface. Tarsal segments trapezoidal, with first segment of hind tarsus longer than second.

MATERIAL EXAMINED. PANAMA, 12 specimens from: CANAL ZONE - Balboa; Madden Forest. COLLECTION DATES: May, June.

OTHER COUNTRIES, 62 specimens from: UNITED STATES, MEXICO, EL SALVADOR, COSTA RICA, COLOMBIA, TRINIDAD.

REMARKS. *Pseudocanthon perplexus* (LeC.) and *P. chlorizans* Bates may be geographic races of a single species (Howden, 1966). Specimens of *chlorizans* Bates as redescribed by Matthews (1966), are seemingly indistinguishable from *perplexus* (LeC.) from the United States. If only one species is represented, then *perplexus* (LeC.) (= *chlorizans* Bates) has one of the most extensive distributions of any Scarabaeinae occurring in Panama, ranging from the United States to South America and to the Antilles and Trinidad.

Specimens have been collected at light, in forest floor litter, in carrion traps, and at human feces. The data suggest nocturnal activity and a wide range of food utilization. The species occurs primarily in lowland forest situations in Panama.

Deltochilum Eschscholtz

Deltochilum Eschscholtz, 1822, p. 37; Howden, 1966, p. 733.

Type-species: *Deltochilum dentipes* Eschscholtz, by monotypy.

Moderate to large species, 12 to 28 mm in length. Anterior edge of clypeus with two or four teeth. Anterior angles of pronotum acute. Elytron with humeral umbone usually with short longitudinal carina and with at least one, often two, additional carinae between umbone and lateral margin of elytron; third to seventh intervals near elytral apex briefly, longitudinally carinate. Middle and hind tibiae not expanded near apices; middle tibia with two apical spines; hind tibia with one apical spine. Anterior tarsus greatly reduced or absent.

Species in the genus are typically ball-rollers, the balls being composed of either dung or carrion.

Key to species of *Deltochilum*

1. Head (in normal position) wider than long: clypeal teeth separated medially by two or more times their own length; pygidium apically rounded, not strongly reflexed at apex 2

Head (in normal position) approximately as long as wide; clypeal teeth separated medially by no more than own length: pygidium apically acute, reflexed (possibly a male character); length 11 to 13 mm . . . . 5. *valgum acropyge* Bates

2. Median clypeal teeth separated by more than three times their length; pygidium nearly flat; second hind tarsal segment as large as third; body length 18 mm or greater 3

Clypeal teeth separated by no more than twice their length; pygidium convex; second hind tarsal segment as large as third and fourth combined; length 17 mm or less 4

3. Anterior half of lateral pronotal margin straight or with a slight curve; dorsal surface black with coppery reflections; length 26 to 28 mm . . . . 1. *gibbosum panamensis* Howd.

Anterior half of lateral pronotal margin sharply sinuate; dorsal surface with purple reflections; length 19 to 22 mm . . . . 2. *mexicanum* Burm.

4. Dorsal surface with bluish reflections; length 14 to 16 mm; margin of hind trochanter feebly toothed in males . . . . 3. *parile* Bates

Dorsal surface with brownish reflections; length
11 to 13 mm; margin of hind trochanter evenly
arcuate in both sexes . . . 4. pseudoparile Paul.

1. Deltochilum gibbosum panamensis Howden

Fig. 54

Deltochilum (Hybomidium) gibbosum panamensis Howden, 1966, p. 736.

Type, Ottawa. Examined.

Length 26 to 28 mm. Color black with coppery reflections. Anterior edge of clypeus (Fig. 54) quadridentate, the outer teeth sometimes feebly developed. Pronotum with lateral margin anterior and posterior to rounded median angle nearly straight, often feebly arcuate either inwardly or outwardly. Elytral striae represented by rows of poorly delimited shallow punctures; umbone longitudinally carinate; between umbone and complete epipleural carina, a humeral carina extends posteriorly slightly less than half length of elytron; five small carinae present near apices of third to seventh intervals. Pygidium very feebly convex, surface with contiguous ocellate punctures. Hind trochanter with tuft of setae.

MATERIAL EXAMINED. PANAMA, 11 specimens from: BOCAS DEL TORO PROV. - Rio Changuinola, 2400 ft. CANAL ZONE - Pipeline Road. COLON PROV. - Santa Rita Ridge. PANAMA PROV. - Cerro Campana. COLLECTION DATES: June, September, October.

OTHER COUNTRIES, 4 specimens (of g. panamensis) from: COSTA RICA; 150 specimens (of gibbosum subspecies) from: UNITED STATES, MEXICO, BELIZE, GUATEMALA, EL SALVADOR (closely related forms are also in South America).

REMARKS. This species has been recorded from human feces and rat carrion. It seemingly is active only at night during the wet season, occurring in moist forests below 1000 m in elevation.

2. Deltochilum mexicanum Burmeister

Fig. 55

Deltochilum mexicanum Burmeister, 1848, p. 135.

Type, Halle (Univ. Mus.). Not seen.

Length 19 to 22 mm. Color black with bluish or purple reflections. Clypeal margin (Fig. 55) anteriorly bidentate, laterally margin on each side distinctly sinuate. Lateral pronotal margin anterior to median angulation abruptly sinuate (almost angulate) near middle. Elytral striae represented by rows of small, indistinct punctures; umbone with well-developed longitudinal carina; epipleural carina complete; five short longitudinal carinae present near apices of third to seventh intervals. Pygidium flat; closely, ocellately punctate. Hind trochanter lacking setae, posterior margin obtusely angulate in both sexes.

MATERIAL EXAMINED. PANAMA, 13 specimens from: BOCAS DEL TORO PROV. - Rio Changuinola, 2400 ft., 5000 ft. CHIRIQUI PROV. - Hartmann's Finca, 1500 m; Repr. la Fortuna, 3200 ft.; Volcan de

Chiriqui, 4000-5000 ft. DARIEN PROV. - Cerro Tacarcuna, 4800 ft. COLLECTION DATES: May, July, September.

OTHER COUNTRIES, 85 specimens from: MEXICO, GUATEMALA, EL SALVADOR, COSTA RICA, COLOMBIA, PERU.

REMARKS. This species has been collected at human feces and unknown carrion. It is active mainly at night and during the wet season. It is restricted to middle elevation moist forest habitats.

3. *Deltochilum parile* Bates

Fig. 56

Deltochilum parile Bates, 1887, p. 35: Paulian, 1938, p. 281.

Lectotype, Paris. Not seen.

Length 14 to 16 mm. Color black, often with bluish reflections. Anterior edge of clypeus (Fig. 56) bidentate, distance between teeth slightly less than twice length of one tooth. Lateral pronotal margin not abruptly angulate, arcuate medially. Elytral striae obsolete, represented by rows of feeble depressions (punctures); humeral umbone feebly carinate, humeral carina extending half the length of elytron, epipleural carina complete; third to seventh elytral intervals each with short carina or tubercle near apex. Pygidium convex, surface with fine scattered punctures. Hind trochanter of male with posterior margin angulate, margin nearly straight in female.

MATERIAL EXAMINED. PANAMA, 5 specimens from: CHIRIQUI PROV. - Hartmann's Finca. COLLECTION DATES: May.

OTHER COUNTRIES, 20 specimens from: COSTA RICA, ECUADOR.

REMARKS. This species has been collected on carrion, and is seemingly active nocturnally. Distribution is restricted to middle and high elevation moist forest habitats.

4. *Deltochilum pseudoparile* Paulian

Fig. 57

Deltochilum (*Deltochilum*) *pseudoparile* Paulian, 1938, p. 283.

Type, Paris. Not seen.

Length 11 to 13 mm. Color black, often with brownish reflections. Anterior edge of clypeus (Fig. 57) bidentate, distance between teeth only one third more than length of one tooth. Lateral pronotal margin arcuate medially, not abruptly angulate. Elytra and associated carinae resembling *parile* except punctures of intervals more pronounced and carina on humeral umbone sometimes doubled. Pygidium only moderately convex, surface with fine scattered punctures. Hind trochanter in both sexes with posterior margin nearly straight.

MATERIAL EXAMINED. PANAMA, 98 specimens from: CANAL ZONE - Barro Colorado Island; Madden Forest; Pipeline Road. COLON PROV. - Santa Rita Ridge. COLLECTION DATES: February, April, June, July, August, September, October, November, December.

OTHER COUNTRIES, 49 specimens from: MEXICO, COSTA RICA.

REMARKS. This species has been recorded from human feces;

and from agouti, peccary, rat, and tamandua carrion. On Barro Colorado Island, *D. pseudoparile* is nocturnally active, has only been collected from carrion, and is most abundant during the late wet season, when vertebrate carcasses are also most abundant. The species is limited in Panama to lowland moist forests.

5. *Deltochilum valgum acropyge* Bates

Figs. 58, 59

Deltochilum acropyge Bates, 1887, p. 36.
Type, London. Examined.
Deltochilum valgum acropyge Bates; Paulian, 1938, p. 273; Howden, 1966, p. 735.

Length 11 to 13 mm. Black, head and pronotum distinctly punctate. Head (Fig. 58) approximately as long as wide; clypeus with two distinct anterior, narrowly separated teeth, and on each side at clypeal-genal margin with low, obtuse tooth; vertex closely punctate, nearly flat; dorsal eyes large. Pronotum with lateral margin angulate at middle, otherwise straight to slightly sinuate before and behind; pronotal surface punctate, closely so laterally and posteriorly. Elytral striae indicated by fine double line, line expanded by widely separated, shallow strial punctures; discal intervals opaque, with numerous shallow, approximate punctures; humeral umbone and apices of third to seventh intervals carinate. Pygidium (Fig. 59) with apex thickened, acutely angled and outwardly produced; disc nearly flat, shallowly punctate. Fore femur with margin unmodified; fore tibia with three apical teeth (the middle one smaller) and numerous serrations on outer margin. Apical half of hind tibia bent inwardly (probably true of males only).

MATERIAL EXAMINED. PANAMA, 1 specimen from: CANAL ZONE - Pipeline Road, 27.V.1977 (Ratcliffe).

OTHER COUNTRIES, 1 specimen (type) from: BELIZE.

REMARKS. The unusual pygidium will readily identify the species. Considering the fact that over 100,000 Scarabaeinae have been examined from Central America and northern South America, with only two specimens of *acropyge* being seen, it would appear that either the species is exceedingly rare or has some unusual habit. The exact status of *acropyge* (= *valgum* or subspecies or valid species) can only be decided when more material becomes available.

Cryptocanthon Balthasar

Cryptocanthon Balthasar, 1942, p. 36; Howden, 1973a, p. 39.
Type-species: *Cryptocanthon paradoxus* Balthasar, by monotypy.

While this genus has not been recorded from Panama there is a strong possibility that it will be found there, since the genus is known to occur in Costa Rica and Colombia. Because of this the generic description is included.

Size small, 2.5 to 4.5 mm, oval (Fig. 60). Clypeus with two teeth on anterior margin; clypeal-frontal suture obsolete. Eye not extending onto dorsal surface of vertex, visible from above only if head extended. Sides of pronotum obtusely angulate; pronotal disc moderately convex except for shallow concavity on each side near lateral posterior margin. Surface of head and pronotum, at least laterally, coarsely punctate. Scutellum absent. Elytron moderately to strongly convex, six or seven obsolete dorsal striae, each indicated by two wavy lines. Intervals flat to slightly convex; most species with a row of setose punctures on each side of each interval. Side of elytron at seventh stria ridged and sharply inflexed (as in some Deltochilum), the inflexed portion at same angle but wider than epipleuron except near apex; epipleuron distinctly raised above inflexed portion of elytron. Pygidium unevenly convex, with a distinct swelling or longitudinal ridge medially, base near midline abruptly transversely concave; basal edge cariniform medially. Prosternum laterally excavated for reception of antennal club. Mesosternum broad, separated from metasternum by curved suture or ridge. Metasternum broadly, evenly convex, lacking any distinct excavations; broad between middle coxae. Abdomen six segmented, terminal segment medially about three times as long as penultimate segment; terminal segment laterally narrower in female than in male. Fore tibia anteriorly truncate. Fore tarsus short, about as long as truncated portion of tibia. Middle and hind tibiae narrow basally, broadened medially and (or) toward apex. Hind tibia often longer and bent inward in male. Antenna nine segmented, club three segmented, similar in shape to club of some Canthon.

Cryptocanthon is not closely related to other New World Canthonini. Balthasar related the genus to Ipselissus Olsoufieff (= Ipsepilissus Paulian) and Zonocopris Arrow, but we believe it is perhaps more closely related to Bdelyropsis Pereira, Vulcano and Martínez. It resembles this latter genus closely in the shape of the thorax (including the elytra) and abdomen. However, Cryptocanthon can be immediately separated from any related New World genus by the shape of the eyes, which do not extend dorsally onto the vertex.

REMARKS. Most of the species have been collected in very wet situations, both in lowland forest and in cloud forest. Specimens have been taken sifting wet litter or in traps baited with human feces. The genus ranges from Mexico to Brazil.

Agamopus Bates

Agamopus Bates, 1887, p. 42; Halffter and Martínez, 1968, p. 226.

Type-species: Agamopus lampros Bates, by monotypy.

Size small to moderate, 3.5 to 6.5 mm; oval, moderately convex. Head with clypeus feebly bidentate; frons and vertex lacking horns or carina, one (South American) species with small tubercle. Pronotum lacking protuberances or grooves, lateral fovea obsolete; posterior marginal bead lacking, at least medially. Scutellum not visible. Elytron with eight striae (nine including epipleural groove), eighth ventro-lateral in position, the seven discal striae represented by slightly indented, punctate lines; intervals nearly flat. Pygidium (Fig. 63) with basal groove and a second, feebly arcuate, deep transverse groove extending across pygidium at apical third. Prosternum declivous anterior to coxae, nearly flat and relatively broad behind. Mesosternum moderately wide, transverse. Metasternum broadly separating middle coxae. Abdominal sternites distinct, narrowed medially. Fore tibia with apical two teeth on outer margin distinct, third tooth often obsolete or poorly developed. Middle tibia gradually expanded to apex; hind tibia only feebly expanded to apex. Hind tarsus with two basal segments subequal, basal segment approximately twice as long as wide, terminal segments long and slender; all tarsi with claws.

Halffter and Martínez (1968) place *Agamopus* in the Canthonina. Previously the genus was incorrectly placed in the Coprini. The genus, containing four or five species, is primarily South American in distribution. All of the members of the genus can be recognized by the relatively slender hind tibia and the very characteristic pygidium with the deep transverse sulcus near the middle.

1. *Agamopus lampros* Bates

Figs. 61, 62, 63

Agamopus lampros Bates, 1887, p. 42; Halffter and Martínez, 1968, p. 236.

Cotypes, London and Paris. London specimens examined.

Length 3.2 to 4.8 mm. Dorsally shining brown to very dark brown; pronotum finely punctate, elytral intervals (Fig. 61) impunctate. Clypeus (Fig. 62) moderately reflexed anteriorly, margin broadly, shallowly emarginate, feebly bidentate; clypeal disc with transverse row of large punctures with scattered adjacent smaller punctures. Frons and vertex smooth to finely punctate posteriorly, protuberances lacking. Eye dorsally wide, approximately 15 facets wide opposite posterior end of gena. Pronotum lacking grooves or indentation, foveae obsolete. Elytral striae represented by fine, shallowly indented punctate lines; intervals nearly flat, shining. Pygidium (Fig. 63) with strong transverse sulcus at apical third. Fore tibia tridentate, basal tooth often poorly developed, inner apical angle acutely produced in male, not produced in female. Hind tibia relatively slender, not expanded apically.

MATERIAL EXAMINED. PANAMA, 26 specimens from: CANAL ZONE - Fort Clayton. CHIRIQUI PROV. - Boqueron; David; Dolega; Potrera. PANAMA PROV. - La Campana; La Chorrera; Rio Las Lajas. COLLECTION DATES: May, September, December.

OTHER COUNTRIES, 46 specimens from: MEXICO, GUATEMALA, EL SALVADOR, COSTA RICA, COLOMBIA.

REMARKS. The species has been taken in traps baited with human feces, and on cow dung, carrion, and at light. *Agamopus lampros* is active at night and is found primarily on fecal material during the wet season. Distribution of the species is seemingly limited to low and mid-elevation areas with scattered forest.

The single Central American species, *lampros*, is easily recognized by its odd, transversely sulcate pygidium (Fig. 63), relatively slender hind tibia, and by the absence of pronotal grooves or indentations.

Pedaridium Harold

Pedaridium Harold, 1868, p. 54; Paulian, 1936, p. 207.

Type-species: *Pedaria hirsuta* Harold, by monotypy.

Size small, body shape oval, sometimes elongate oval; dorsally setose, sometimes sparsely so. Clypeal margin bi- or quadri-dentate; head lacking horns or tubercles, some species with vertex feebly carinate; eyes dorsally narrow to moderate in width, narrowed posteriorly. Pronotum convex, lacking horns, protuberances or grooves; lateral fovea obsolete; posterior marginal bead absent; lateral pronotal bead with close, ventral parallel carina at edge of episternum, the ventral carina obsolete or absent in anterior third. Scutellum absent or not visible. Elytral disc with eight striae, each stria represented by either a narrow, shallowly indented, sometimes punctate, line or by a depressed band of confused punctures; elytral intervals flat or raised, each side of interval with a row of setose punctures (the related genus *Trichillum* Har. has only a single row of punctures on each interval). Pygidium variable in size and convexity. Mesosternum wide medially, separated from metasternum by wide U- or V-shaped suture. Metasternum between posterior half of middle coxae broad, surface punctate, setose, at least minutely so. Abdominal sternites usually narrowed and fused along midline. Fore tibia with two or three small teeth on outer margin in apical third. Hind tibia gradually expanded toward apex, oval or flattened in cross section at apical third. Hind tarsus with basal segment shorter than adjacent segment, usually not slender and elongate.

Pedaridium and its close relative *Trichillum* are badly in need of revision as the characters distinguishing the genera are poorly defined and variable. Both genera contain a number of small (under 10 mm) species. All have some dorsal setae and are distinctly convex. *Pedaridium* is distinguished from *Trichillum* (Paulian, 1936, Martínez, 1967) mainly on the basis of the length of the basal segment of the hind tarsus. In *Pedaridium* this segment is shorter than the next, while in *Trichillum* it is longer. The difficulty in utilizing this character is illustrated by the original placement of the two Central American species in *Trichillum* when, according to the characters utilized by Martínez, 1967, and others they should be placed in the genus *Pedaridium*. Based only on present usage the three Panamanian species in this complex should all be assigned to *Pedaridium*.

Key to species of *Pedaridium*

1. Clypeal margin quadridentate; vertex nearly flat, evenly, feebly convex 2
Clypeal margin broadly bidentate; vertex with feeble transverse carina; length 3.5 mm . . . . .

. . . . 3. bottimeri n. sp.

2. Elytra with longitudinal median third of intervals convex and bare, the area between including striae composed of broad band of confused punctures, a row of conspicuous setae on each side; length 3.0 to 3.5 mm . . . . 1. pilosum (Rob.)
Elytral intervals flat, each with row of small punctures on each side, most punctures each with short, inconspicuous setae; elytral striae represented by line and row of punctures; length 3.3 mm . . . . 2. brevisetosum n. sp.

1. Pedaridium pilosum (Robinson) New Combination

Figs. 66, 67, 68

Trichillum pilosus Robinson, 1948, p. 149.
Type, Washington. Examined.

Length 3.0 to 4.1 mm. Dorsally dark brown to black; head, pronotum and elytra (Fig. 66) with numerous, conspicuous, erect setae; elytral setae approximately as long as width of one interval. Clypeus (Fig. 67) quadridentate, inner teeth slender, separated by a broad U-shaped emargination; lateral teeth approximately half length of inner ones. Entire surface of head, clypeal disc, frons and vertex even, very slightly convex; evenly, coarsely punctate; each puncture with erect seta, surface between punctures smooth and shining; eye dorsally narrowed posteriorly, at posterior of gena only one to three facets wide. Pronotum with fovea represented by a small, shining, rounded swelling; surface of pronotum closely, coarsely punctate; punctures usually separated by less than one diameter, each puncture with central seta. Elytra with inconspicuous, crenately punctate striae; each interval on each side adjacent to striae with row of coarse punctures, middle longitudinal half of interval impunctate, shining, convexly elevated; seventh interval carinate, eighth interval feebly so; apical sixth of other intervals often carinate. Pygidium and ventral surfaces including femora coarsely punctate; punctures often shallow, most setose. Fore tibia with three small teeth on outer margin in apical half. Sexual differences slight; male with slightly less convex pygidium and with apical tibial spur wider. Male genitalia as in fig. 68.

MATERIAL EXAMINED. PANAMA, 89 specimens from: BOCAS DEL TORO PROV. - Almirante. CANAL ZONE - Barro Colorado Island; Rio Ciricito; Madden Forest; Pipeline Road; Skunk Hollow. CHIRIQUI PROV. - Hartmann's Finca, 1200 m, 1500 m. COCLE PROV. - El Valle, 2200 ft. COLON PROV. - Santa Rita Ridge. PANAMA PROV. - Cerro Campana. COLLECTION DATES: January, February, March, April, May, June, July.

OTHER COUNTRIES, 39 specimens from: COSTA RICA, ECUADOR.

REMARKS. This species has been collected in light traps; in forest floor litter; in the fermented crown of a felled palm; at horse, human, peccary, sloth, and tapir feces; and on unidentified carrion. Pedaridium pilosum is nocturnally active and most abundant in the dry season on Barro Colorado Island, where it seems to be found almost exclusively on dung. The species occurs in both low and middle elevation moist forest.

There is one species, P. bradyporum Bouc. that occurs in Costa Rica that might be confused with pilosum. The species was originally described in the genus Trichillum but as in the case of pilosum should be placed in Pedaridium if one is to follow current usage. If bradyporum is found in Panama, which would appear likely, it may be distinguished from pilosum by the following combination of characters: size smaller, approximately 3 mm, less oval, setae slightly reduced in number and length, seventh elytral interval moderately carinate but with apical sixth of remaining intervals not distinctly carinate. In addition, the punctures in the elytral intervals are smaller and distinctly separated while in pilosum they are contiguous or nearly so. The characters separating pilosum from the other two Panamanian species are given in the key.

2. Pedaridium brevisetosum n. sp.

Figs. 69, 70, 71

HOLOTYPE. Male, length 3.3 mm, greatest width 2.0 mm. Dorsally very dark brown with scattered short erect setae (Fig. 69) on head, pronotum and elytra. Head and pronotum closely, similarly punctate; punctures separated by approximately one diameter; punctures of elytral intervals irregular, frequently small to minute. Clypeus (Fig. 70) broadly quadridentate, the inner two teeth slender, widely separated by shallow emargination; two lateral teeth with bases in nearly straight line with bases of inner teeth; lateral teeth small, approximately half length of inner teeth. Clypeus on each side laterad to outer teeth with a slight obtuse angle present indicating that, in some specimens, six teeth might be present. Clypeal disc, frons, and vertex essentially in same plane, feebly convex. Eye dorsally moderate in size, narrowed posteriorly, two facets wide at posterior edge of gena. Pronotum almost evenly convex, lateral fovea indicated by a slightly raised irregular area. Elytra with striae indicated by faintly impressed lines, crenately punctate; intervals flat to feebly convex laterally, not carinate, surface mostly smooth and shining, a few coarse punctures present on either side near striae. Placement of punctures irregular and in some areas intervals completely impunctate; most coarse punctures each with short erect seta. Pygidium convex, punctate-setose. All ventral surfaces closely punctate, setose; in some areas punctures shallow; abdominal sternites one to five constricted and fused at coxal edge near mid-line, apical (sixth sternite) the only obvious segment extending across midline. Fore tibia with two distinct teeth on outer margin near apex; tibial spur small, nearly as broad as long. Male genitalia as in fig. 71.

FEMALE. Unknown.

TYPE MATERIAL: Holotype, male, Panama, Canal Zone, Barro Colorado Island, 9°10'N, 79°50'W, 16.VI.1977, H.A. Hespenheide

(Howden).

REMARKS. The non-carinate head and very feebly punctate elytral intervals will distinguish this species from the others known to occur in Panama. The male genitalia are also very distinctive.

3. Pedaridium bottimeri n. sp.

Figs. 72, 73, 74

HOLOTYPE. Male, length 3.5 mm, greatest width 2.4 mm. Dorsally very dark brown. Head, pronotum (Fig. 72) and, to a lesser degree, elytral intervals coarsely punctate; pronotal punctures separated by one to three diameters, each with an upright seta. Clypeus (Fig. 73) bidentate, teeth widely separated, acutely angled; emargination between teeth shallow, approximately one quarter as wide as head. Clypeal disc with widely separated punctures, surface between very finely shagreened, shining. Frons between anterior margins of eyes with low transverse carina; carina depressed at midline, extending approximately two-thirds of distance between inner margins of eyes. Vertex behind carina with punctures similar to those on pronotum. Eye dorsally moderately wide, narrowed posteriorly; four facets wide at posterior end of gena. Pronotum evenly convex, lateral fovea indicated by faint irregular swelling. Elytra with striae slightly indented; strial lines interrupted by well-spaced crenate punctures separated by three to four diameters. Elytral intervals slightly convex with scattered punctures on each side near striae; placement and size of punctures both being highly irregular, but with punctures generally more numerous laterally and in apical half; seventh interval rounded, not carinate. Pygidium moderately convex; basal groove very distinct, nearly twice as wide as in other Panamanian species; pygidial surface with scattered coarse punctures, punctures medially separated by one to two diameters. Ventral surfaces moderately punctate, femora feebly so; punctures often with short setae. Sternites one to five becoming fused near median third and very narrow, the narrow fused sternite extending across the midline; width of this sternite one tenth or less the median width of sixth sternite; sixth sternite approximately twice as wide medially as laterally. Fore tibia with three distinct teeth on outer margin in apical half; tibial spur distinct, broad at base, narrowing to acute apex. Male genitalia as in fig. 74.

FEMALE. Unknown.

TYPE MATERIAL: Holotype, male, Panama, Canal Zone, Barro Colorado Island, 13.VII.1963, L.J. Bottimer (Ottawa). Paratype, 1 male, Panama, Canal Zone, Coco Solo Hospital, 7.VII.1975 (Ratcliffe).

REMARKS. The bidentate clypeus and the transverse carina on the frons will immediately distinguish this species from any others known to occur in Panama or neighboring countries. It is interesting to note that while the external morphology differs radically from pilosum, the genitalia are quite similar. This is the reverse of the situation found in brevisetosum which morphologically appears more closely related to pilosum except for the characters of the genitalia which show radical differences.

The species described above is named in honor of Mr. L.J. Bottimer who has collected a number of the species mentioned in this paper.

Bdelyrus Harold

Bdelyrus Harold, 1869a, p. 97; Pereira, Vulcano and Martínez, 1960, p. 155.

Type-species: Bdelyrus lagopus Harold, by monotypy.

Size moderate, 6 to 10 mm. Body shape elongate oval; feebly to moderately longitudinally convex dorsally. Most of dorsal surfaces distinctly punctate. Head lacking horns, tubercles or transverse carinae; clypeal margin obsoletely emarginate and very slightly reflexed medially, or moderately emarginate or produced and reflexed at and near midline. Pronotum lacking protuberances, fovea or abrupt indentations. Scutellum not visible. Elytra each with seven discal striae, the outer stria adjacent to abrupt carina delimiting sharply inflexed epipleuron; discal striae represented by broad, shining, sometimes punctate lines; lines, at most, feebly impressed. Pygidium varying in convexity, often nearly horizontal, in approximately same plane as terminal sternite. Prosternum declivous anterior to coxae, broad and nearly flat posteriorly. Mesosternum broadly transverse. Metasternum anteriorly widely separating middle coxae, inner coxal margins very slightly convergent posteriorly. Abdominal sternites not fused medially, sutural lines distinct. Fore tibia relatively broad and flattened in apical half, apically truncate, outer margin in apical half with three distinct teeth. Anterior tarsus small, length approximately equal to apical width of tibia; tarsal claws small, often concealed by long setae. Middle and hind tarsi with basal segments approximately as broad as long, long ventral setae often obscuring segments; width of segments diminishing to apex.

The closely related Mexican-Central American genus Bdelyropsis Pereira, Vulcano and Martínez, is easily separated from Bdelyrus by its distinctly bidentate clypeus with a deep V- or U-shaped median emargination. For other generic differences and the descriptions of the Mexican-Central American species of Bdelyropsis, see Howden, 1971.

1. Bdelyrus seminudus (Bates)

Figs. 64, 65

Aphengium seminudum Bates, 1887, p. 42.

Cotypes, London and Paris. London specimen examined.

Bdelyrus seminudus (Bates); Pereira, Vulcano and Martínez, 1960, p. 155.

Length 6 to 8 mm. Dark brown to black; dorsum (Fig. 64) closely punctate, less so in elytral striae; punctures in most areas separated by one to three diameters; most punctures each with minute central seta, some punctures annular; pronotum medially with fine secondary punctures. Clypeal margin (Fig. 65) very shallowly, broadly emarginate medially, not distinctly reflexed. Eyes dorsally 8 to 12 facets wide near posterior edge of gena. Pronotum with marginal bead poorly developed, absent posteriorly. Elytral striae each represented by slightly impressed line interrupted by moderate sized non-setose punctures. Pygidium with posterior groove; surface punctate, shining between punctures. Obvious sexual modification lacking.

MATERIAL EXAMINED. PANAMA, 9 specimens from: CHIRIQUI PROV. - Volcan de Chiriqui (cotypes). PANAMA PROV. - Cerro Campana, 3000 ft., VIII; Cerro Jefe, 9°12'N, 79°21'W, 700 m, VI.

OTHER COUNTRIES, 42 specimens from: NICARAGUA, COSTA RICA, COLOMBIA.

REMARKS. Only two recently (1970 to date) collected specimens were seen from Panama. While Bdelyrus seminudus does come to traps baited with human feces, closely related South American species have been taken in the bracts of Heliconia and from bromeliads. Others have been collected under wood chips from a freshly felled tree in heavy Amazonian forest.

There are apparently several undescribed species in the genus which is seemingly best represented in the Amazonian region.

Onthocharis Westwood

Onthocharis Westwood, 1847, p. 230.

Type-species: Onthocharis mirmidon Westwood, listed by Lucas, 1920.

Body shape elongate; dorsally glabrous, shining. Clypeus bidentate, quadridentate or sexdentate; frons and vertex smooth, tumid, slightly carinate or feebly bituberculate. Eye dorsally narrow, usually less than six facets in width. Pronotum relatively evenly convex, lacking horns, tubercles, ridges or grooves; lateral fovea small, shallow or obsolete. Scutellum minute or invisible. Elytra nearly parallel sided; striae distinct, depressed; intervals feebly to distinctly convex. Pygidium evenly convex, relatively large. Mesosternum short to moderate in length. Metasternum anteriorly broadly separating middle coxae; inner edges of coxae slightly convergent posteriorly. Fore tibia with three teeth on outer apical half. Middle and hind tibiae broad and distinctly flattened. Middle and hind tarsi with at least basal segment greatly expanded and flattened in species 5 mm and over in size; in species 5 mm and under basal tarsal segment often elongate, only slightly flattened.

This genus has not been carefully studied since Westwood defined it in 1847. The above description defines the genus following current usage. However, as noted by Paulian (1939) the one Panamanian species is atypical and actually belongs to a group of small species, usually less than 5 mm in length, that has a shortened mesosternum and a narrow, elongate basal segment of the hind tarsus. Seemingly the closest relative to the Panamanian species is one occurring in the Upper Amazon basin near Leticia, Colombia.

1. *Onthocharis panamensis* Paulian

Figs. 75, 76

Onthocharis panamensis Paulian, 1939, p. 145.

Type, Cambridge. Examined.

Length 3.5 to 4.0 mm, greatest width 1.8 mm; body shape (Fig. 75) elongate, elytra distinctly longer than wide, almost parallel sided. Dorsally shining, brownish black with cupreous reflection or shining green; pronotal surface with numerous fairly uniformly but widely-spaced small punctures. Clypeus (Fig. 76) with two slender, elongate teeth, one on each side of U-shaped median emargination; lateral to each elongate tooth, an obtuse tooth and beyond a second feeble or obsolete tooth; i.e. clypeal margin with four distinct teeth and two feeble or obsolete ones. Posterior clypeal disc and frons medially somewhat tumid, at posterior edge on each side of swelling a feeble tubercle indicated. Surface of head closely, finely punctate; eyes dorsally very narrow. Pronotum lacking protuberances or grooves, lateral fovea shallow, small; anterior and lateral marginal bead present, bead lacking posteriorly. Elytral striae distinctly indented, obsoletely punctate; intervals convex, some with minute, scattered punctures; otherwise surface smooth and shining. Pygidium relatively large, smooth, shining, with scattered fine punctures. Fore tibia tridentate.

MATERIAL EXAMINED. PANAMA, 2 specimens from: CANAL ZONE - Barro Colorado Island. PANAMA PROV. - Cerro Campana, 850 m, 21.IV.1978.

REMARKS. The small size, shining dorsum, four or six toothed clypeus, and elongate body shape should be sufficient to recognize the species. This is the only species in the genus recorded from Central America. The habits of *panamensis* are unknown; one specimen was taken sitting on a leaf.

Scatimus Erichson

Scatimus Erichson, 1847, p. 110; Balthasar, 1939, p. 87.

Type-species: *Scatimus cucullatus* Erichson, by monotypy.

Size moderate, 5 to 7 mm. Color dark brown to black. Anterior clypeal margin dentate or distinctly sinuate; clypeal surface not rugose. Frons with transverse carina extending approximately five-sixth distance between anterior margins of eyes. Pronotum evenly convex; lateral fovea distinct, a line of punctures extending anteriorly, line sometimes very abbreviated. Elytron with eight striae, six between suture and umbone, intervals on disc flat, polished. Pygidium transverse, basal marginal groove pronounced. Mesosternum closely, distinctly punctate. Middle coxae widely separated, inner margins parallel. Abdomen with six sternites, basal four often narrowed near midline particularly in males. Middle and hind tibiae expanded toward apex; outer tibial surface with one, sometimes two transverse carinae.

The genus may be confused with some *Uroxys* or *Ateuchus*, but the transverse carina of the frons and the distinctly punctate mesosternum will distinguish *Scatimus*.

Key to species of Scatimus

1. Carina on frons often at least slightly elevated laterally, the carina medially posteriorly arcuate . . . . 1. quadridentatus Balth.
   Carina on frons not elevated laterally, the carina medially anteriorly arcuate . 2. ovatus Har.

1. Scatimus quadridentatus Balthasar

Figs. 77, 78, 79

Scatimus quadridentatus Balthasar, 1939, p. 89.

Type, Prague. Not seen.

Length 4.5 to 7.0 mm. Clypeus (Figs. 77, 78) anteriorly sharply bidentate, margin laterally lobed, sinuate or arcuate. Eye dorsally, in typical specimens, large, not narrowed posteriorly, about 1.3 times longer than wide to posterior edge of gena. In atypical specimens (usually from lower elevations) eye dorsally distinctly narrowed posteriorly, about twice as long as wide to posterior edge of gena. Frons with carina extending three-quarters the distance between anterior margins of eyes, carina highest laterally; carina posteriorly arcuate. Pronotum either with lateral line of four or more punctures extending anteriorly before lateral fovea or with clump of punctures in an elongate depression anterior to fovea. Fore femur with posterior (ventral) surface with scattered to numerous coarse punctures; numerous coarse punctures often present on specimens with narrowed eyes. Male fore tibial spur not modified. Genitalia as in fig. 79.

MATERIAL EXAMINED. PANAMA, 28 specimens from: CHIRIQUI PROV. - 2 km N Sta. Clara, Hartmann's Finca, 1200 m. COLON PROV. - 10 mi. SE Colon, Santa Rita Ridge, 270 m. COCLE PROV. - El Valle. PANAMA PROV. - Cerro Campana, 800 m. COLLECTION DATES: May, June, July, December.

OTHER COUNTRIES, 6 specimens from: COSTA RICA.

REMARKS. Specimens from Costa Rica and Chiriqui Prov., Panama, all have the wide dorsal eyes. Two females from Cerro Campana, Panama Prov., vary slightly in eye width, being slightly wider than those from the Santa Rita Ridge. Specimens from Santa Rita Ridge, Colon Prov., all have the eyes narrowed dorsally. Initially we believed that two close species were represented. Subsequently, after examining the male genitalia and being unable to detect any differences and noting a seeming convergence in eye size, we now consider the variation in eye size as possibly intraspecific. Since eye size often is related to time of activity (nocturnal or diurnal) it is possible that we have combined two species under the name quadridentatus. However, some proof is needed to show if the difference in eye size is or is not coupled with behaviorial differences.

Specimens have been taken at light, at carrion and in traps baited with human feces.

2. Scatimus ovatus Harold

Figs. 80, 81

Scatimus ovatus Harold, 1862, p. 401.

Type or cotype, Paris. Not seen.

Length 5 to 7 mm. Clypeus (Fig. 80) anteriorly feebly bidentate, margin laterally arcuate or somewhat sinuate. Eye dorsally narrow, nearly twice as long as wide. Frons anterior to eyes with low transverse carina of uniform height; carina anteriorly arcuate (median portion of carina anterior in position). Pronotum with longitudinal line of punctures extending from lateral fovea, two or three punctures usually present posterior to fovea and a line anteriorly composed of 10 or more punctures, some contiguous. Fore femur with at least half of posterior (ventral) surface coarsely punctate. Male fore tibial spur not modified. Genitalia as in fig. 81.

MATERIAL EXAMINED. PANAMA, 131 specimens from: CANAL ZONE - Barro Colorado Island; Cabima; Camaron Arm; Coco Solo Hospital; Fort Clayton; Fort Gulick; Madden Forest; Tabernilla. CHIRIQUI PROV. - Algarrobo; Bugaba, 800-1500 ft.; David; Dolega; Gualaca; Potera; Rio Tabasara. COCLE PROV. - El Valle; Penonome. COLON PROV. - Santa Rita Ridge. LOS SANTOS PROV. - Macaracas. PANAMA PROV. - Cerro Campana; Cermeno; La Chorrera; Tocumen. VERAGUAS PROV. - Farallon. COLLECTION DATES: January, May, June, July, September, October, November, December.

OTHER COUNTRIES, 29 specimens from: MEXICO, EL SALVADOR, COSTA RICA, COLOMBIA.

REMARKS. The species S. ovatus has either an unusually wide range or, quite possibly, several species are included under the name. There is geographical variation in the size of the eye dorsally, shape of the clypeal teeth, dorsal punctation, etc., but in Panama the specimens seen exhibit little of this variation.

This species has been captured on the feces of horse, cow, howler monkey, man, spider monkey, and tapir.

S. ovatus is active at night, occurs only on fecal material, and is restricted to the wet season. Its distribution is one of the broadest of the Scarabaeinae in Panama, occurring in the lowland forests of all but two provinces.

Uroxys Westwood

Uroxys Westwood, 1842, p. 59; 1847, p. 229.

Type-species: Uroxys cuprescens Westwood, by monotypy.

Length 3 to 11 mm. Color red-brown to black. Anterior clypeal margin dentate; clypeal-frontal area sometimes with transverse carina. Pronotum with longitudinal groove near lateral edge; posterior margin with adjacent row of shallow, longitudinal punctures. Elytron with eight striae; intervals on disc flat, polished. Pygidium wider than long, with disc smooth and with basal marginal sulcus or groove pronounced. Underside glabrous, punctate. Fore tibia usually with three distal teeth on outer margin, rest of margin not serrate. Middle coxae widely separated.

Sexual dimorphism often evident in clypeal surfaces, fore tibiae, pronotal edges, sixth ventral abdominal segment, and pygidium.

The genus *Uroxys* is not clearly defined and is badly in need of a revision. As currently constituted it seems close to *Scatimus* and *Agamopus*, but the pronotal groove, lack of a distinct transverse carina on the middle tibia and, in many species, the sexual dimorphism will distinguish *Uroxys* from related genera.

Key to species of *Uroxys*

1. Anterior of frons with transverse ridge(s) or groove (sometimes feeble); pronotum often strongly convex behind anterior margin, sides near middle nearly parallel 2

Anterior of frons evenly convex, without carina or groove, sometimes feebly, transversely rugose, becoming more strongly so on clypeus; pronotum relatively evenly convex, sides arcuate or angled near middle 4

2. Frons with one distinct transverse carina; pronotum with lateral longitudinal groove not extending to anterior and posterior margins; length greater than 6 mm 3

Frons with two slight, parallel transverse elevations with depression between; pronotum with lateral longitudinal groove extending to anterior and posterior margins; length less than 6 mm . . . . 3. *depressifrons* n. sp.

3. Meso-metasternal suture broadly arcuate anteriorly; distance between dorsal ocular areas approximately seven times their width; posterior margin of hind trochanter continuous with posterior margin of femur; length 9 to 11 mm . . . . 1. *gorgon* Arr.

Meso-metasternal suture sharply angulate anteriorly; distance between dorsal ocular areas approximately 8.5 times their width; hind trochanter projecting laterally; length 6 to 7.5 mm . . . . 2. *metagorgon* n. sp.

4. Dorsal ocular area approximately as long as wide; distance between eyes two to three times one eye width 5

Dorsal ocular area at least twice as long as wide; distance between eyes at least four times eye width 7

5. Male pygidium flat; female with sixth ventral abdominal segment as long medially as segments two to five combined; length 4 to 5 mm . . . . .

. . . . 6. _platypyga_ n. sp.
Male pygidium strongly convex; female with sixth ventral abdominal segment no longer medially than segments four and five combined; length 3 to 4 mm 6

6. Anterior margin of clypeus bidentate, slightly indented immediately lateral to teeth, which are weakly reflexed; male with two strong teeth on fore tibia, basal tooth much reduced . . . . 8. _bidentis_ n. sp.
Anterior margin of clypeus with three strong indentations, teeth and margin abruptly reflexed; male with three strong teeth on fore tibia . . . . .7. _macrocularis_ n. sp.

7. Basal sulcus of pygidium strongly sinuate; length 3 to 4.5 mm 8
Basal sulcus of pygidium feebly sinuate or straight on each side of midline; length 5 to 6 mm 9

8. Dorsal ocular areas twice as long as wide; distance between ocular areas five times their width . . . . 4. _micros_ Bates
Dorsal ocular areas three times as long as wide; distance between ocular areas eight times their width . . . . . 5. _microcularis_ n. sp.

9. Males with fore tibial spur short, spatulate and obliquely truncate; clypeal margin straight adjacent to clypeogenal suture . .9. _gatunensis_ n. sp.
Males with fore tibial spur slender and deflexed distally; clypeal margin indented at junction with clypeogenal suture . . . .
. . . . 10. _dybasi_ n. sp.

1. _Uroxys gorgon_ Arrow

Figs. 82, 83, 102, 103

Uroxys gorgon Arrow, 1933, p. 397.
Type, London. Examined.

MALE. Major form, length 9 to 11 mm. Oblong, shining black. Clypeus (Figs. 82, 102) bidentate, teeth elongate and strongly reflexed. Head dorsally very finely punctate. Genal margins obtusely angulate and reflexed; clypeogenal suture distinct and depressed. Transverse carina on frons moderately elevated, weakly arcuate anteriorly. Dorsal ocular areas approximately 1.5 times as long as width at posterior edge of canthus (±17 facets wide at that point), distance between ocular areas approximately seven times their width. Pronotum parallel sided for most of length, as wide as elytra; transverse tumosity present at anterior third; a small depression on each side of midline adjacent to anterior margin; lateral posterior marginal area nearly vertical, lateral anterior area almost horizontal; surface faintly punctate; median longitudinal sulcus feebly present in posterior fourth; lateral fovea in form of deep longitudinal sulcus extending over half length of pronotum but not reaching anterior or posterior margin, sulcus faintly crenulate; pronotum distinctly margined basally with row of large longitudinal punctures immediately anterior to margin. Elytron strongly convex, faintly punctate, with slight humeral umbone; striae distinct but shallow, with distinct punctures evenly spaced for most of length of each stria; posterior fifth of striae one and two deeply furrowed; intervals flat, faintly punctate; apices flattened but not produced. Mesosternum faintly punctate; meso-metasternal suture medially broadly anteriorly arcuate, angulate laterally, almost touching anterior margin of mesosternum, as close to margin as to mesocoxal cavity; metasternum swollen but not keeled and with median posterior depression. Ventral abdominal segments five and six of equal median length and each longer than segments 2, 3, or 4; sixth segment narrowed medially. Pygidium (Fig. 103) moderately convex, faintly punctate, twice as wide as long; deep sulcus surrounding disc, margin formed being twice as wide apically as laterally; sulcus basally straight or slightly arcuate toward apex on each side of midline. Fore tibia with three outer distal teeth equidistant from each other, proximal tooth somewhat reduced; bases of all teeth occupying less than half of length of outer margin; inner margin curved; distal end with large decurved rounded projection at inner corner, projection as long as tibial spur; tibial spur stout, blunt, both decurved and recurved. Middle and hind femora strongly widened medially; posterior margin strongly elevated, with a flattened projection medially; posterior margin of hind trochanter even with posterior margin of femur. Genitalia as in fig. 83. Minor form: differing from major form in the following characters: length 8 to 10 mm; clypeal dentition reduced, margins of gena only weakly reflexed, carina on frons reduced to a slight elevation; fore tibia less elongated and curved.

FEMALE. Differing from male in the following characters: transverse carina on frons strongly elevated; fore tibia shorter and broader; sixth abdominal segment not narrowed medially; pygidium wider and shorter.

MATERIAL EXAMINED. PANAMA, 54 specimens from: BOCAS DEL TORO PROV. - Almirante. CANAL ZONE - Barro Colorado Island; Rio Agua Salud. COLON PROV. - Santa Rita Ridge. PANAMA PROV. - Cerro Campana. COLLECTION DATES: Every month of the year.

OTHER COUNTRIES, 18 specimens from: COSTA RICA, COLOMBIA, ECUADOR.

REMARKS. Uroxys gorgon, on the basis of size alone, cannot be confused with any other species of Uroxys known to occur in Panama.

This nocturnal species has been recorded at light, perching on leaf surfaces, in fur of live three-toed sloths, on pellets of *Dynastor darius* (a large Lepidoptera) in rearing cage, and at sloth and toad feces. It apparently shares with *U. metagorgon* the unique habit of attaching itself to the fur of living sloths which live in lowland moist forests. Closely related species in South America are also associated with sloths.

On Barro Colorado Island, laboratory experiments suggest that *gorgon* can survive on the feces of a wide variety of vertebrates, but in the field specimens are much more restricted in their range of fecal utilization. Sloth feces occurring on the ground is normally quite hard and dry, and in the laboratory *gorgon* will starve to death in the presence of this material. Freshly produced sloth feces (<5 min.) is normally soft enough to allow consumption by dung beetles, and perhaps only consumers riding on the sloth can effectively utilize this potential food source.

2. *Uroxys metagorgon* n. sp.

Figs. 100, 101, 106

HOLOTYPE. Male, length 7.5 mm; elytra only, 4.0 mm; width 4.4 mm. Oblong, shiny, reddish black (teneral). Clypeus (Fig. 100) bidentate, teeth strongly reflexed, triangular in shape. Margin of gena obtusely angulate. Surface of head finely punctate. Clypeogenal suture distinct but superficial. Transverse carina on frons moderately elevated, weakly arcuate anteriorly. Dorsal ocular areas approximately twice as long as width at posterior edge of canthus (±12 facets wide at that point), distance between ocular areas approximately 8.5 times their width; frons posteriorly with faint wrinkles. Pronotum parallel sided for most of length, wider than elytra; disc with transverse tumosity at anterior third, small depression adjacent to anterior margin on each side of midline; lateral posterior area nearly vertical, lateral anterior area almost horizontal; surface finely punctate; median longitudinal sulcus feebly expressed in posterior fourth; lateral fovea in form of deep longitudinal sulcus extending over half length of pronotum but not reaching anterior or posterior margin; sulcus distinctly crenulate with distinct punctures anteriorly; pronotum distinctly margined basally with row of large longitudinal punctures immediately anterior to margin. Elytron strongly convex, finely punctate, with slight umbone; each stria distinct but shallow, with distinct punctures evenly spaced for most of length; posterior fifth of first and second striae furrowed; intervals flat; apices flattened on intervals one and two, but not produced. Mesosternum finely punctate; meso-metasternal suture sharply anteriorly arcuate, angulate laterally, almost touching anterior margin of mesosternum, as close to margin as to mesocoxal cavity; distance between anterior margin of mesocoxal cavity and anterior margin of mesosternum equal to (in other species 0.5x, except *depressifrons* and *dybasi*) length of pleurosternal suture posterior to forecoxa; metasternum slightly swollen, with median posterior depression. Ventral abdominal segments 2, 3, 4, and 5 of equal median length, each shorter than sixth; sixth segment narrowed medially. Pygidium (Fig. 101) moderately convex, faintly punctate, twice as wide as long; sulcus surrounding disc deep, forming margin twice as wide apically as basally; sulcus basally straight either side of midline. Fore tibia with three outer distal teeth equidistant from each other, proximal tooth somewhat reduced; all three teeth occupying approximately half of outer margin of tibia; inner margin evenly curved; distal end with large decurved scalpriform projection at inner corner, projection as long as tibial spur; tibial spur stout with rounded apex, outline sinuate. Middle and hind femora strongly widened medially; posterior margin elevated; hind trochanter projecting laterally. Genitalia as in fig. 106.

ALLOTYPE. Female, length 7.0 mm; elytra only, 3.8 mm; width 3.8 mm. Differing from male in the following characters: anterior clypeal teeth shorter, broader, and less reflexed; transverse carina on frons only slightly elevated; pronotum without anterior depressions at margin, not as wide as elytra; fore tibia shorter and broader, sixth abdominal segment not narrowed medially.

TYPE MATERIAL: Holotype, male, Panama, Canal Zone, Barro Colorado Island, 12.IX.1972, O.P. Young, light trap (Washington). Allotype, female, same data as holotype, except 27.VII.1971 (Washington).

PARATYPES: 8 males, 4 females. PANAMA: 2 males, 4 females, same data as holotype except 16.XI.1971, 12.IX.1972, 31.X.1972, 31.VII.1973, 2.X.1973, I.1974; 3 males, Canal Zone, Barro Colorado Island, (1) 18.I.1959, H.S. Dybas, at light, (1) 3.VI.1971, O.P. Young, on live three-toed sloth, (1) 8.V.1935, A.E. Emerson, in fur of sloth; 1 male, Colon Prov., Santa Rita Ridge, 200 m, 16.X.1976, A. Thurman, whitelight. COSTA RICA: 2 males, Turrialba, 13-17.III.1965, S.S. and W.D. Duckworth.

Paratypes are in: Chicago, Washington, Howden, Ratcliffe.

REMARKS. *Uroxys metagorgon* is closely related to *gorgon*, but can be distinguished from that species by the combination of smaller size, dorsal ocular areas relatively more elongate and farther apart, absence of reflexed genal margins, meso-metasternal suture sharply angulate medially, shape of distal projection of fore tibia, and projecting hind trochanter. Specimens examined from Brazil and Ecuador, although similar, show consistent differences that seem to indicate specific or subspecific differences. They are therefore excluded from the type series.

This species is nocturnal, occurs primarily in the wet season, and has been recorded from light and from the fur of live three-toed sloths (see remarks under *U. gorgon*). Distribution is apparently restricted in Panama to lowland moist forests.

3. *Uroxys depressifrons* n. sp.

Figs. 98, 99, 104, 105

HOLOTYPE. Male, length 5.0 mm; elytra only, 2.6 mm; width 2.2 mm. Oblong, faintly shining, reddish black. Anterior clypeal margin quadridentate, medially strongly emarginate (Figs. 98, 104); margin reflexed, teeth more abruptly so. Genal margin broadly rounded; clypeogenal suture indistinct. Surface of head distinctly punctate. Frontal area (Fig. 104) with two slight transverse elevations and depression between. Dorsal ocular areas approximately 1.5 times as long as width at posterior edge of canthus (9 to 11 facets wide at that point), distance between ocular areas approximately four times their width. Pronotum moderately convex, without anterior tumosity; two-thirds of lateral margin nearly vertical; surface minutely punctate; median longitudinal sulcus feebly indicated in posterior fourth; lateral fovea in form of deep and straight longitudinal sulcus, faintly crenulate, extending to both anterior and posterior pronotal margins; pronotum distinctly margined posteriorly with row of longitudinal punctures immediately anterior to margin. Elytron moderately convex, faintly punctate, with slight humeral umbone; striae depressed, with faint punctures evenly spaced, posterior one-fifth of first and second striae deeply furrowed, fourth extending farther posteriorly than third, eighth terminating before joining second; intervals flat, smooth; apices flattened but not produced. Mesosternum faintly punctate; meso-metasternal suture medially sharply arcuate anteriorly, broadly rounded laterally, suture farther from mesocoxal margins than from anterior margin of mesosternum; median longitudinal depression of metasternum distinct on posterior two-thirds. Ventral abdominal segments two to five of approximately equal median length, segment six narrowed medially and twice as long as segment five. Pygidium (Fig. 99) moderately convex, minutely punctate, 1.5 times as wide as long; sulcus surrounding disc deeper basally, forming margin of equal width laterally and at apex; sulcus basally straight either side of midline. Fore tibia stout, with three outer distal teeth equidistant from each other, proximal tooth somewhat reduced; all three teeth occupying at least two-thirds of outer margin of tibia; inner margin slightly curved; distal end with small deflexed pointed projection at inner corner, projection half as long as tibial spur; tibial spur elongate, tapering to point. Middle and hind femora moderately widened medially, posterior margin weakly elevated; posterior margin of hind trochanter even with posterior margin of femur. Genitalia as in fig. 105.

ALLOTYPE. Female, length 4.0 mm; elytra only, 2.3 mm; width 2.1 mm. Differing from male in the following characters: fore tibia relatively shorter and broader; sixth ventral abdominal segment not narrowed medially.

TYPE MATERIAL: Holotype, male, Panama, Chiriqui Prov., 15 km NW Hato del Volcan, Hartmann's Finca, 1500 m, 20-31.V.1977, S. Peck, dung trap (Howden). Allotype, female, same data as holotype except 20-25.V.1977 (Howden).

PARATYPES: 48 males, 57 females. PANAMA: 10 males, 18 females, Chiriqui Prov., 2 km W Cerro Punta, Baldwin Forest, 30.V.-8.VI.1977, 3.VI.1977, S. Peck, H. Howden, human dung traps; 4 males, 1 female, Chiriqui Prov., 2 km E Cerro Punta, 2200 m, 28.V.-8.VI.1977, S. Peck, human dung traps; 2 males, 2 females, Chiriqui Prov., 2 km N Sta. Clara, 1300 m, 8°51'N, 82°46'W, Hartmann's Finca, 30-31.V.1977, H. & A. Howden; 14 males, 15 females, Chiriqui Prov., 15 km NW Hato del Volcan, Hartmann's Finca, 1200 m, 1500 m, 1550 m, 20-25.V.1977, 20-31.V.1977, 25,30, 31.V.1977, S. Peck, human dung traps, carrion traps; 1 female, Chiriqui Prov., Las Lagunas, 4 km W Hato del Volcan, 1200 m, 27.V.1977, H. & A. Howden, human dung traps; 11 males, 12 females, Chiriqui Prov., Las Lagunas, 5 km SW Hato del Volcan, 1360 m, 22-26, 27.V.1977, S. Peck, human dung traps, S. & J. Peck, Berlese of carrion; 1 female, Cocle Prov., El Valle, trail to Las Minas, 2400-2600 ft., 21.II.1959, H.S. Dybas, Berlese of horse manure along trail. COSTA RICA: 7 males, 7 females, Punt., Monteverde, 1400 m, 1500 m, 23,27.V.1979, 1.VI.1979, 24-28.II.1980, H. & A. Howden, R.S. Anderson, in human dung trap, sitting on leaves near trail at night.

Paratypes are in: Cambridge, Chicago, Ottawa, Washington, Howden, Ratcliffe, Riley.

REMARKS. In body shape and clypeal elevations *depressifrons* is closest to *U. gorgon* and *U. metagorgon*, but it can be easily separated on the basis of size. Panamanian species of *Uroxys* of similar size do not have clypeal elevations or the elongate parallel-sided body shape.

This nocturnal species occurs in the higher elevations of Panama and Costa Rica in areas where the "dry" season is quite moist. It has been captured perching on leaf surfaces, at carrion, and on horse and human feces.

4. *Uroxys micros* Bates

Figs. 90, 91, 108, 109, 110

Uroxys micros Bates, 1887, p. 43.

Cotypes, London and Paris. London specimens examined.

MALE. Length 4 to 4.5 mm; elytra only, 2.7 mm; width 2.9 mm. Oval, shining black. Clypeus (figs. 90, 109) bidentate, not indented immediately laterad of teeth, which are broadly triangular and strongly reflexed. Genal margin broadly rounded. Clypeogenal suture distinct; clypeal margin indented where suture intersects. Frons weakly convex, without elevations. Dorsal ocular areas approximately twice as long as width at posterior edge of canthus (seven to nine facets wide at that point), distance between ocular areas approximately five times their width. Head surface with fine punctures posteriorly, coarse punctures anteriorly. Pronotum (Fig. 108) as wide as elytra; lateral edges of pronotum extended into prominent angles, strongly sinuate in lateral view, posterior third of margin nearly vertical; pronotum weakly convex medially, surface finely punctate; median longitudinal sulcus present in posterior fourth; lateral fovea in form of shallow, non-crenulated longitudinal groove two-thirds as long as length of pronotum and extending to posterior margin; pronotum indistinctly margined basally with adjacent row of large longitudinal punctures. Elytron moderately convex, faintly punctate, with very slight humeral umbone; striae distinct but shallow, with distinct punctures evenly spaced for most of length of each stria and with posterior fifth of first and second striae slightly furrowed, seventh stria extending three-fifths length of elytron; intervals flat; apices somewhat flattened but not produced. Mesosternum faintly punctate; meso-metasternal suture medially moderately angulate anteriorly, weakly angulate laterally, three times farther from anterior margin of mesosternum than from mesocoxal cavity; metasternum swollen, with faint or obsolete median posterior depression; hind coxa with portion of posterior margin in form of triangular projection directed posteriorly (usually under femur). Ventral abdominal segments two to five of equal length medially and each half as long medially as sixth segment; sixth not narrowed medially. Pygidium (Fig. 91) strongly convex, faintly punctate, 1.5 times as wide as long; sulcus surrounding disc deep basally, shallow elsewhere, margin formed being slightly wider apically than laterally; sulcus basally strongly trisinuate, separating from disc two lateral rounded expansions, the median basal area of disc narrowed. Fore tibia elongate with inner margin sinuate; three outer distal teeth with proximal tooth somewhat reduced and 1.5 times farther from middle tooth than middle tooth is from distal tooth; bases of all teeth occupying approximately apical third of outer margin; apical end of tibia with small decurved pointed projection at inner corner, less than one-fourth length of tibial spur. Tibial spur elongate, thick, blunt, strongly deflexed on distal third, extending to middle of distal segment of tarsus. Fore femur strongly constricted distally, middle and hind femora slightly widened medially; posterior margin of hind trochanter continuous with posterior margin of femur. Genitalia as in fig. 110.

FEMALE. Differing from male in the following characters: clypeus transversely rugose, lateral pronotal fovea not extending to posterior margin, fore tibia relatively shorter and broader, middle coxa without posterior projection, sixth ventral abdominal segment longest medially, and pygidium 2.5 times as wide as long.

MATERIAL EXAMINED. PANAMA, 88 specimens from: CANAL ZONE - Barro Colorado Island; Fort Kobbe; Frijoles; Pipeline Road; Skunk Hollow. COLON PROV. - Portobello. COLLECTION DATES: Every month of the year except August.

OTHER COUNTRIES, 10 specimens from: COSTA RICA, GUATEMALA.

REMARKS. There are six species of Uroxys in Panama that are 5.0 mm or less in body length, oval in shape, lack elevations on the frons, and that form a separate group from the preceding three species. Because micros is the only previously described species in this group, the assemblage is referred to as the micros-complex. Males of micros are distinguished from other species of the complex by the presence of a projection on the posterior margin of the metacoxa. Both males and females of micros have the most strongly sinuate pygidial sulcus basally of any member of the complex, the sinuation producing a narrowed median basal portion of the pygidial disc.

This nocturnal species has been captured at light, from forest floor leaf litter, perching on leaf surfaces, at peccary carrion, and on howler monkey, human, tapir, and toad feces.

5. *Uroxys* *microcularis* n. sp.

Figs. 92, 93, 112, 113

HOLOTYPE. Male, length 3.7 mm; elytra only, 2.2 mm; width 2.5 mm. Oval, shining black. Clypeus (Fig. 92) bidentate, not indented immediately laterad to narrowly triangular, strongly reflexed teeth. Head surface with fine punctures posteriorly, coarse punctures anteriorly, and with slight rugosity along lateral and anterior edges. Clypeogenal suture present but indistinct; genal margin weakly angulate immediately posterior to intersection of suture. Frons weakly convex, without elevations. Dorsal ocular areas approximately three times as long as width at posterior edge of canthus (three to five facets wide at that point), distance between ocular areas approximately eight times their width. Pronotum slightly narrower than elytra; lateral edges of pronotum produced into prominent angles, strongly sinuate in lateral view, posterior third of margin nearly vertical; pronotum weakly convex medially, surface finely punctate; median longitudinal sulcus present in posterior fourth; lateral fovea in form of shallow, non-crenulated, longitudinal groove two-thirds as long as pronotum and extending to posterior margin; pronotum indistinctly margined basally with adjacent row of large, longitudinal punctures. Elytron moderately convex, faintly punctate, with very slight humeral umbone; striae distinct but shallow, with distinct punctures evenly spaced for most of length of each stria; posterior fifth of first and second striae slightly furrowed, seventh stria extending three-fifths length of elytron; intervals flat; apex somewhat flattened but not produced. Mesosternum feebly punctate; meso-metasternal suture medially moderately angulate anteriorly, weakly angulate laterally, three times farther from anterior margin of mesosternum than from mesocoxal cavity; metasternum swollen, with very slight median posterior depression; hind coxa without posterior projection. Ventral abdominal segments two to five of equal length medially and each segment half as long medially as sixth; sixth not narrowed medially. Pygidium (Fig. 93) strongly convex, faintly punctate, 1.5 times as wide as long; sulcus surrounding disc deep basally, shallow elsewhere, forming margin slightly wider apically than laterally; sulcus basally trisinuate, delimiting two lateral rounded expansions, the resultant three curves of basal sulcus of equal magnitude. Fore tibia elongate with inner margin sinuate; three outer distal teeth equidistant from each other, proximal tooth somewhat reduced; all three teeth occupying approximately one-third of outer margin; distal end with small deflexed pointed projection at inner corner, projection less than one-fourth length of tibial spur. Tibial spur elongate, thick, blunt, strongly decurved on distal third, extending to middle of distal segment of tarsus. Fore femur strongly constricted distally, middle and hind femora slightly widened medially; posterior margin of hind trochanter continuous with posterior margin of femur. Genitalia as in figs. 112, 113.

ALLOTYPE. Female, length 3.6 mm; elytra only, 2.2 mm; width 2.4 mm. Differing from the holotype in the following characters: clypeus transversely rugose, clypeal margin indented immediately lateral to teeth, fore tibia relatively shorter and broader, fore tibial spur thinner, sixth ventral abdominal segment longest medially, and pygidium twice as wide as long.

TYPE MATERIAL: Holotype, male, Panama, Colon Prov., Santa Rita Ridge, 300 m, 10-11.VI.1977, H. & A. Howden (Howden). Allotype, female, Panama, Canal Zone, 5 mi NW Gamboa, 7.IV.1970, M.A.R.U., light trap (Washington).

PARATYPES: 70 males, 67 females. PANAMA: 4 males, 4 females, Canal Zone, Barro Colorado Island, 20-23.V.1964, 31.V. 1970, W.D. & S.S. Duckworth, H.A. Hespenheide: 1 male, Canal Zone, Coco Solo Hospital, 11.XII.1971, Stockwell, manure trap: 1 female. Canal Zone, Cerro Campana, 19.IX.1954, O.L. Cartwright; 1 female, Canal Zone, Cristobal, 5.X.1965, Navy collection, light trap; 1 male, Canal Zone, Fort Clayton, 22.IX.1952; 3 males, Canal Zone, Ft. Gulick, 13.X.1953, 2 males, 4 females, Canal Zone, Fort Kobbe, 14.VI.1976, 24.VI.1976, E.G. Riley, blacklight trap; 1 female, Canal Zone, 4 mi. W Gatun, 6.V.1973, H.P. Stockwell; 22 males, 29 females, Canal Zone, Skunk Hollow, 7.VII.1975, 13. VII.1975, 18-21.V.1976, B.C. Ratcliffe; 1 female, Canal Zone, Pacific area, VIII.1965, Navy collection, light trap; 19 males, 9 females, Cocle Prov., El Valle, trail to Las Minas, 2400-2600 ft., 20.II.1959, H.S. Dybas, in dung; 3 males, 3 females, Cocle Prov., El Valle, 2200 ft., 23.II.1959, H.S. Dybas, Berlese, horse manure on trail; 12 males, 7 females, Cocle Prov., El Valle, along tributary of Rio Anton, 2200 ft., H.S. Dybas, in horse manure; 1 female, Panama Prov., Cermeno, 11.IX.1952; 1 male, 1 female, Panama Prov., Chagres Bridge nr. Madden Dam, 8.X.1952; 1 male, Panama Prov., Molinga Swamp (= Mojinga Swamp?), 15.VII.1952; 3 females, Panama Prov., Potera, 11.IX.1952; 1 male, 1 female, Panama Prov., Rio Sajalices near Villa Real, 12.IV.1952; 1 female, Panama Prov., Tocumen, 25.X.1952.

Paratypes are in: Chicago, Ottawa, Washington, Howden, Ratcliffe, Riley.

REMARKS. Males and females of *micrOcularis* can be separated from other members of the *micros* complex in Panama by the combination of the small dorsal ocular areas, three times as long as wide, separated by the large relative distance of eight times their width.

This nocturnal species is usually collected in the wet season and has been taken at light, and on horse, human, and tapir feces. It is seemingly distributed throughout the moist forests of Panama.

6. *Uroxys platypyga* n. sp.

Figs. 84, 85, 107

HOLOTYPE. Male, length 4.7 mm; elytra only, 2.8 mm; width 3.0 mm. Oval, shining black. Clypeus (Fig. 84) bidentate, faintly indented immediately laterad of broadly triangular and weakly reflexed teeth. Head surface with fine punctures posteriorly, coarse punctures anteriorly. Clypeogenal suture distinct;

genal margin rounded and weakly angulate immediately posterior to intersection of suture. Frons feebly convex, without elevations. Dorsal ocular areas approximately as long as width at posterior edge of canthus (19 to 21 facets wide at that point), distance between ocular areas approximately twice their width. Pronotum slightly narrower than elytra; lateral edges of pronotum produced into prominent angles, strongly sinuate in lateral view, posterior third of margin nearly vertical; pronotum weakly convex medially, surface finely punctate; median longitudinal sulcus evident in posterior fourth; lateral fovea in form of shallow, non-crenulate longitudinal groove two-thirds length of pronotum; groove extending nearly to posterior margin, anterior portion of groove terminating near several large punctures; pronotum distinctly margined basally and with adjacent row of large longitudinal punctures. Elytron moderately convex, faintly punctate, with slight umbone; striae distinct but shallow, with distinct punctures evenly spaced for most of each stria, seventh stria extending three-fifths of length of elytron; intervals flat, apices flattened, not produced. Mesosternum faintly punctate: meso-metasternal suture medially narrowly arcuate anteriorly, rounded laterally; suture three times farther from anterior margin of mesosternum than from mesocoxal cavity; metasternum swollen, with median posterior groove absent; hind coxa without posterior projection. Ventral abdominal segments two to five of equal length medially, sixth segment as long as 3, 4, and 5 combined and longer medially than laterally. Pygidium (Fig. 85) flat medially, faintly punctate, twice as wide as long; sulcus surrounding disc deep basally, shallow elsewhere; sulcus basally trisinuate, separating from disc two lateral expansions; resultant median basal area of disc narrowed. Fore tibia elongate with inner margin sinuate; outer margin with three teeth, basal tooth slightly reduced and 1.5 times farther from middle tooth than middle tooth is from apical one; all three teeth occupying approximately one-third of outer margin; distal end with small projection at inner corner, projection less than one-fourth length of tibial spur; tibial spur elongate, thick, blunt, strongly deflexed in distal third, extending as far as base of distal segment of tarsus. Fore femur strongly constricted distally, middle and hind femora slightly widened medially; posterior margin of hind trochanter continuous with posterior margin of femur. Genitalia as in fig. 107.

ALLOTYPE. Female, length 4.1 mm; elytra only, 2.3 mm; width 2.7 mm. Differing from male in the following characters: clypeus transversely rugose, fore tibia relatively short and broad, fore tibial spur thinner; sixth ventral abdominal segment as long medially as segments two to five combined; pygidium three times as wide as long and strongly convex.

TYPE MATERIAL: Holotype, male, Panama, Canal Zone, Barro Colorado Island, 16.I.1975, O.P. Young, tapir feces trap (Washington). Allotype, female, Panama, Canal Zone, Barro Colorado Island, 13.V.1974, O.P. Young, human feces trap (Washington).

PARATYPES: 14 males, 24 females. PANAMA: 11 males, 17 females, Canal Zone, Barro Colorado Island, 31.VII.1938, VII.1941, IX.1941, VII-VIII.1942, VI-X.1943, IV-X.1947, 17-19.I.1959, IV.1970, 6.IV.1970, 10.IV.1970, 6.II.1972, 19,21.V.1972, 9.III.1974, 16.I. 1975, 16-17.III.1975, 15,16,17.IX.1975, R.T. Allen, leaf debris, J. Zetek, Berlese funnel, O.P. Young, tapir, human feces, rat carrion, H.S. Dybas, R. Foster, H.A. Hespenheide, E.C. Williams; 1 male, Canal Zone, Fort Kobbe, 24.VI.1976, E.G. Riley; 3 females, Canal Zone, Madden Forest, mile 2.5, 20.XII.1971, 6.II.1972, H.P. Stockwell, manure trap; 1 male, 3 females, Canal Zone, 5 mi. NW Gamboa, 30.III.1970, 7.IV.1970, M.A.R.U., light trap; 1 male, 1 female, Panama Prov., Aguacate, 300 m, 18.VI.1970, B. Chaniotis, at light.

Paratypes are in: Chicago, Ottawa, Washington, Howden, Ratcliffe, Riley.

REMARKS. Other members of the micros complex in Panama possess, in both sexes, a strongly convex pygidium. The males of platypyga, however, have the pygidium flat medially, and the aedeagus is unique within the complex with very short, truncate parameres. The female has the largest sixth abdominal segment of any member of the micros complex, the segment being as long medially as segments two to five combined. Other species have the sixth segment no longer medially than segments four and five combined.

The species is active at night in both the wet and dry seasons and has been collected at light, under leaf debris, at rat and unknown carrion, and on human and tapir feces. The distribution of platypyga in Panama is restricted to moist lowland forests.

7. Uroxys macrocularis n. sp.

Figs. 86, 87, 114

HOLOTYPE. Male, length 3.4 mm; elytra only, 2.0 mm; width 2.4 mm. Oval, shining red (teneral). Clypeus (Fig. 86) with three indentations, median one most pronounced, indentations delimiting pair of reflexed, broadly triangular teeth; margin lateral to outer indentation straight and reflexed. Surface of head with fine punctures posteriorly, coarse punctures anteriorly, with slight rugosity along lateral and anterior edges. Clypeogenal suture distinct; genal margin angulate immediately posterior to intersection of suture. Frons weakly convex, without elevations. Dorsal ocular areas approximately as long as width at posterior edge of canthus (14 to 16 facets wide at that point), distance between ocular areas approximately twice their width. Pronotum slightly narrower than elytra; lateral edge of pronotum produced into prominent angle, strongly sinuate in lateral view; posterior third of margin nearly vertical; pronotum weakly convex medially, surface finely punctate; median longitudinal sulcus absent; lateral fovea in form of shallow, non-crenulated longitudinal groove two-thirds length of pronotum and extending to posterior margin; pronotum indistinctly margined basally, with adjacent row of large longitudinal punctures. Elytron moderately convex, faintly punctate, with small humeral umbone; striae distinct but shallow, with distinct punctures evenly spaced for most of length of each stria; posterior fifth of first and second striae slightly furrowed, seventh extending three-fifths length of elytra; intervals flat; apices flattened, slightly produced at end of fifth stria. Mesosternum faintly punctate; meso-metasternal suture medially moderately angulate anteriorly, weakly angulate laterally; three times farther from anterior margin of mesosternum than it is from mesocoxal cavity; metasternum swollen, with very slight median posterior depression; hind coxa without posterior projection. Ventral abdominal segments two to six of equal length medially; sixth of equal length throughout. Pygidium (Fig. 87) strongly convex, faintly punctate, twice as wide as long; sulcus surrounding disc deep basally, shallow elsewhere, margin formed wider apically than laterally; sulcus basally trisinuate, separating from disc two feeble lateral expansions; three curves of the basal sulcus of equal magnitude. Fore tibia elongate with inner margin sinuate; outer margin with three equidistant teeth in apical third, basal tooth somewhat reduced; distal end of tibia with small deflexed pointed projection at inner apex, projection less than one-eighth as long as tibial spur. Tibial spur elongate, thick, blunt, strongly curved in distal third, extending as far as base of apical tarsal segment. Fore femur narrowed distally, middle and hind femora slightly widened medially; posterior margin of hind trochanter continuous with posterior margin of femur. Genitalia as in fig. 114.

ALLOTYPE. Female, length 3.4 mm; elytra only, 2.0 mm; width 2.4 mm. Differing from male in the following characters: clypeus transversely rugose, fore tibia relatively short and broad, fore tibial spur thinner, sixth ventral abdominal segment longest medially and twice as long as fifth segment.

TYPE MATERIAL: Holotype, male, Panama, Canal Zone, Gamboa, 28.IV.1975, O.P. Young, tapir feces trap (Washington). Allotype, female, Panama, Canal Zone, 5 mi. NW Gamboa, 13.IV.1970, M.A.R.U., light trap (Washington).

PARATYPES: 6 males, 3 females. PANAMA: 1 female, Canal Zone, Barro Colorado Island, X-XI.1941, Zetek; 6 males, 2 females, Canal Zone, 5 mi. NW Gamboa, 23.III.1970, 20.IV.1970, 28.IV.1975, M.A.R.U., O.P. Young, light trap, tapir feces trap.

Paratypes are in: Washington, Howden.

REMARKS. Males of *macrocularis* can be distinguished from males of other members of the *micros* complex in Panama by the three indentations of the anterior clypeal margin. The median indentation is most pronounced, but the lateral indentations are also distinct. The entire clypeal margin is strongly reflexed. These characteristics are found in females of several species but not in other males. Females of *macrocularis* appear to be most closely related to *bidentis* which is similar in the pygidium, sixth ventral abdominal segment, and dorsal ocular areas. Females of *macrocularis* may be distinguished by the three indentations of the clypeal margin. The anterior clypeal margin of *bidentis* is only medially indented and the teeth are only feebly reflexed.

Uroxys macrocularis is active at night in both the wet and dry seasons. It has been collected only in the moist forest areas of the Canal Zone where it has been taken at light and on tapir feces.

8. Uroxys bidentis n. sp.

Figs. 88, 89, 111

HOLOTYPE. Male, length 3.7 mm; elytra only, 2.3 mm; width 2.3 mm. Oval, shining black. Clypeus (Fig. 88) bidentate, teeth narrowly triangular and weakly reflexed. Surface of head with fine punctures posteriorly, coarse punctures anteriorly, without rugosity. Clypeogenal suture distinct; genal margin weakly angulate immediately posterior to intersection of suture, otherwise rounded. Frons weakly convex, without elevations. Dorsal ocular areas approximately as long as width at posterior edge of canthus (14 to 16 facets wide at that point), distance between ocular areas approximately twice their width. Pronotum slightly narrower than elytra; lateral edges of pronotum produced into prominent angles, strongly sinuate in lateral view, posterior third of margin nearly vertical; pronotum weakly convex medially, surface finely punctate; median longitudinal sulcus evident in posterior fourth; lateral fovea in form of shallow, non-crenulated longitudinal groove two-thirds the length of pronotum and extending to posterior margin; pronotum indistinctly margined basally with adjacent row of large longitudinal punctures. Elytron moderately convex, finely punctate; humeral umbone small; striae distinct but shallow, with indistinct punctures evenly spaced for most of length, posterior tenth of first and second striae slightly furrowed, seventh stria extending three-fifths of length of elytron; intervals flat, apices slightly flattened but not produced. Mesosternum faintly punctate; meso-metasternal suture medially narrowly arcuate anteriorly, rounded laterally, three times farther from anterior margin of mesosternum than from mesocoxal cavity; metasternum swollen, with very slight median posterior groove; hind coxa without posterior projection. Ventral abdominal segments two to five each of equal median length and each 1.5 times shorter medially than sixth; sixth segment of uniform width. Pygidium (Fig. 89) strongly convex, faintly punctate, twice as wide as long; sulcus surrounding disc deep basally, shallow elsewhere; margin formed slightly wider apically than laterally; sulcus basally trisinuate, separating from disc two lateral expansions; the three curves of basal portion of sulcus of equal magnitude. Fore tibia elongate with inner margin sinuate; outer margin with three teeth in apical third, basal tooth reduced to small projection and 1.5 times farther from middle tooth than middle tooth is from apical tooth; tibial apex with very small decurved projection at inner corner, projection less than one-eighth length of tibial spur. Tibial spur elongate, thick, blunt, strongly decurved on distal third, extending to base of distal segment of tarsus. Fore femur strongly constricted distally, middle and hind femora slightly widened medially; posterior margin of hind trochanter continuous with posterior margin of femur. Genitalia as in fig. 111.

ALLOTYPE. Female, length 3.3 mm; elytra only, 1.9 mm; width 2.1 mm. Differing from male in the following characters: clypeus transversely rugose; fore tibia relatively short and broad, with proximal tooth reduced by half; fore tibial spur thinner; sixth ventral abdominal segment longest medially and twice as long as fifth segment.

TYPE MATERIAL: Holotype, male, Panama, Chiriqui Prov., 2 km W Cerro Punta, Baldwin Forest, 3.VI.1977, H. Howden, cup traps (Howden). Allotype, female, same data as holotype (Howden).

PARATYPES: 46 males, 22 females. PANAMA: 18 males, 8 females, Chiriqui Prov., Las Lagunas, 4 km W Hato del Volcan, 1200 m, 1360 m, 27.V.1977, 1.VI.1977, 5-6.VI.1977, 8.VI.1977, H. & A. Howden, 4 human dung traps-3 day run, dung traps, evening sweepings; 6 males, 6 females, Las Lagunas, 5 km SW Hato del Volcan, 1360 m, 22.V.1977, S. & J. Peck, dung traps, litter; 4 males, 1 female, Chiriqui Prov., 2 km N Sta. Clara, Hartmann's Finca, 1300 m, 30-31.V.1977, H. & A. Howden, human dung traps; 1 male, 2 females, Chiriqui Prov., Hartmann's Finca, 20.V.1977, 25.V.1977, S. & J. Peck, litter, under bark, dung traps; 9 males, 4 females, Chiriqui Prov., 2 km W Cerro Punta, Baldwin Forest, 3.VI.1977, H. Howden, human dung traps; 1 male, Chiriqui Prov., Cerro Punta, 1500 m, 23.V.1977, H. Howden, human dung traps; 2 males, 1 female, Chiriqui Prov., 2 km W Cerro Punta, 1300 m, 22,27,29.V.1977, H. Howden, human dung traps; 4 males, Chiriqui Prov., 2.5 km W Cerro Punta, 1720 m, 28.XI.1975, H.P. Stockwell, manure trap; 1 male, Chiriqui Prov., W Finca Palo Santo, near Nueva California, 4900 ft., 6.III.1959, Berlese - floor litter in ravine.

Paratypes are in: Chicago, Ottawa, Washington, Howden.

REMARKS. Male members of the *micros* complex in Panama all have the proximal tooth on the outer distal margin of the fore tibia reduced to some degree. However, *bidentis* is the only species in which the males have the basal tooth of the fore tibia reduced by more than half, to the extent that most of the paratypes seemingly lack the basal tooth. See remarks under *macrocularis* for differentiation of females.

Uroxys bidentis is nocturnal, occurs in both wet and dry seasons, and has been found perching on leaf surfaces, under bark, in forest floor litter, and on human feces. It is seemingly restricted to the higher elevations (>1000 m) in Chiriqui Province.

9. *Uroxys gatunensis* n. sp.

Figs. 94, 95

HOLOTYPE. Male, length 5.0 mm; elytra only, 3.2 mm; width 3.4 mm. Oval, shining red (teneral). Clypeus (Fig. 94) bidentate, teeth broadly triangular and strongly reflexed. Head surface smooth on vertex; laterally and anteriorly with very fine punctures. Clypeogenal suture distinct; clypeal margin angulate immediately posterior to intersection of suture, margin of gena rounded. Frons weakly convex, without elevations. Dorsal ocular areas approximately twice as long as width at posterior edge of canthus (8 to 10 facets wide at that point), distance between ocular areas approximately five times their width. Pronotum slightly narrower than elytra; lateral edges of pronotum produced into prominent angles, strongly sinuate in lateral view, posterior half of margin vertical; pronotum weakly convex medially; surface with scattered, fine punctures; median longitudinal sulcus evident in posterior third; lateral fovea in form of shallow, smooth longitudinal groove one-third length of pronotum and not extending to either anterior or posterior margin; pronotum margined basally, with adjacent row of large longitudinal punctures. Elytron moderately convex, faintly punctate, humeral umbone small; striae distinct but shallow, with distinct punctures evenly spaced for most of length, seventh stria extending two-fifths of length of elytron, posterior fifth of first and second striae slightly furrowed; intervals flat, apices slightly flattened but not produced. Mesosternum faintly punctate; meso-metasternal suture medially narrowly arcuate anteriorly, weakly angulate laterally; suture three times farther from anterior margin of mesosternum than from mesocoxal cavity; metasternum swollen, with slight median posterior depression; hind coxa without posterior projection. Ventral abdominal segments two to five of equal length medially and each half as long as sixth; sixth slightly longer medially than laterally. Pygidium (Fig. 95) strongly convex, faintly punctate, twice as wide as long; sulcus surrounding disc deep basally, shallow elsewhere; margin formed of same width apically and laterally; sulcus basally slightly arcuate toward apex on each side of midline. Fore tibia elongate with inner margin sinuate; outer margin with three teeth in apical two-fifths, teeth approximately equidistant from each other, basal tooth somewhat reduced; apical end of fore tibia with short, wide, blunt deflexed projection at inner corner less than one-fourth length of tibial spur. Tibial spur short, spatulate, obliquely truncated, extending to fourth tarsal segment. Fore femur narrowed distally, middle and hind femora slightly widened medially; posterior margin of hind trochanter continuous with posterior margin of femur. Genitalia collapsed (teneral).

FEMALE. Unknown.

TYPE MATERIAL: Holotype, male, Panama, Canal Zone, Barro Colorado Island, 16.I.1975, O.P. Young, tapir feces trap (Washington).

REMARKS. The male of gatunensis is unique among members of the micros complex in Panama due to the presence of a spatulate, obliquely truncated fore tibial spur; in all other species both males and females possess elongate, tubular, distally deflexed spurs.

This species is named for Gatun Lake, the body of water surrounding Barro Colorado Island, Panama.

10. Uroxys dybasi n. sp.

Figs. 96, 97, 115, 116, 117

HOLOTYPE. Male, length 6.0 mm; elytra only, 3.5 mm; width 3.5 mm. Elongate oval, shining reddish black. Clypeus (Figs.

96, 115) bidentate, slightly indented immediately laterad of teeth; teeth broadly triangular and strongly reflexed. Head surface with slight anterior transverse rugosity, distinct small punctures throughout. Clypeogenal suture distinct; clypeal margin distinctly indented at intersection of suture; genal margins broadly rounded. Frons weakly convex, with very slight, broad indentations. Dorsal ocular areas approximately twice as long as width at posterior edge of canthus (12 to 14 facets wide at that point), distance between ocular areas approximately five times their width. Pronotum (Fig. 115) at median angulation as wide as elytra; lateral edges of pronotum produced into prominent angles, strongly sinuate in lateral view, posterior two-thirds of margin nearly vertical; pronotum weakly convex medially; surface densely covered with fine, deep punctures; median longitudinal sulcus feebly indicated in posterior third; lateral fovea in form of crenulated longitudinal deep groove three-fourths length of pronotum, not extending to either anterior or posterior margin, with cluster of coarse punctures in posterior third; pronotum margined basally, with adjacent row of large longitudinal punctures. Elytron moderately convex, faintly punctate, humeral umbone small; striae distinct but shallow, with distinct punctures evenly spaced for most of length of each stria, seventh stria extending three-fifths length of elytron; posterior tenth of first stria furrowed; intervals flat, apices slightly flattened and constricted, not produced. Mesosternum faintly punctate; meso-metasternal suture medially moderately angulate anteriorly, moderately angulate laterally, three times farther from anterior margin of mesosternum than from mesocoxal cavity; distance between anterior margin of mesocoxal cavity and anterior margin of mesosternum similar to distance between pleurosternal suture posterior to fore coxa; metasternum swollen, with distinct median posterior depression; hind coxa without posterior projection. Ventral abdominal segments two to five of equal length medially, each only slightly shorter medially than sixth; sixth slightly longer laterally than medially. Pygidium (Fig. 97) strongly convex, faintly punctate, twice as wide as long; sulcus surrounding disc deep basally, shallow elsewhere; margin formed of same width apically and laterally; sulcus basally very slightly arcuate toward apex on each side of midline. Fore tibia elongate with inner margin broadly curved; outer margin with three teeth in apical third, teeth approximately equidistant, basal tooth somewhat reduced and more broadly triangular; apex of fore tibia with short, narrow, rounded, deflexed projection at inner corner, projection approximately half length of tibial spur. Tibial spur elongate, straight, pointed, extending to fourth tarsal segment. Fore femur gradually tapering distally, hind femur with slight median ventral posterior swelling; posterior margin of hind trochanter continuous with posterior margin of femur. Genitalia as in figs. 116, 117.

FEMALE. Unknown.

TYPE MATERIAL: Holotype, male, Panama, Camp Chagres, 26-27.X.1967, T. Taylor (Chicago).

PARATYPE: 1 male. COSTA RICA: Punt., Monteverde, 1500 m, 27.V.1979, H. & A. Howden, in carrion traps (Howden).

REMARKS. This species is most closely related in Panama to *gatunensis* from which it can be separated by the combination of indented lateral clypeal margin, shaft-like fore tibial spur, angulate meso-metasternal suture, and very broad basal fore tibial tooth.

This species is named for Henry Dybas in appreciation of his many contributions to our studies.

Ateuchus Weber

Ateuchus Weber, 1801, p. 10; Chapin, 1946, p. 79.

Type-species: *Ateuchus histeroides* Weber, by monotypy.

Choeridium Serville, 1828, p. 356; Bates, 1887, p. 44; Balthasar, 1939d, p. 44; Chapin, 1946, p. 79.

Size small to moderate (4 to 11 mm in Panama); oval (Fig. 118), strongly convex. Head with clypeus feebly to distinctly bidentate; frons and vertex lacking horns, distinct tubercles or carinae. Pronotum relatively evenly convex, lacking posterior marginal bead; lacking punctures or indented line before or behind lateral fovea. Scutellum absent. Elytron with eight striae. Fore coxa transverse, not conical. Middle coxae widely separated, inner margins parallel. Fore tibia with three or four teeth on outer margin, the margin basally lacking distinct serrations. Males of most species with fore tibial spur expanded. Hind tibia lacking transverse carinae on outer surface; hind tibia strongly expanded in apical half.

Of the various genera treated in this work, the names used for the Panama species of *Ateuchus* are the least certain. In his key to the genus, Balthasar (1939d) discussed a number of problems encountered in his study that indicates that a thorough revision is needed.

Key to species of *Ateuchus*

1. Elytral striae moderately impressed, at least the inner four striae of each elytron moderately to strongly impressed near apex; elytra usually dark brown or black, lacking distinct green or golden cast 2

Elytral striae feebly impressed, only slightly more impressed near apices; elytra usually with distinct green or golden cast. . . 2. *aeneomicans* (Har.)

2. Size moderate, usually 6 mm or more; elytral intervals dull, opaque . . . . . 1. *candezei* (Har.)

Size small, usually under 5.5 mm; elytral intervals shining, polished . . 3. *guatemalensis* (Bates)

1. Ateuchus candezei (Harold)

Figs. 118, 119

Choeridium candezei Harold, 1868, p. 82.

Type or cotype, Paris. Not seen.

Length 5.9 to 7.1 mm. Dorsally very dark brown to black; head and pronotum shining, frequently with cupreous cast, elytra dull, opaque. Clypeal margin anteriorly broadly (male) to moderately (female) V-shaped, tooth on each side rounded to acute, at least slightly more prominent than margin laterally; margin laterally arcuate; clypeal disc (Fig. 119) finely punctate, punctures larger and more numerous near margins. Frons and vertex feebly tumid, smooth to very finely punctate; eye dorsally relatively narrow, about seven facets wide in basal half. Pronotum minutely punctate or impunctate laterally, impunctate medially. Elytral striae (Fig. 118) distinctly impressed and with widely separated small punctures; intervals feebly convex, surface smooth, finely granular, giving dull appearance. Pygidium with indented groove just anterior to basal marginal bead, surface at least in basal half, dull. Fore tibia with three teeth on outer margin; fore tibial spur of males expanded into a slightly irregular, transverse oval shape; female spur slender, slightly bent near acute apex.

MATERIAL EXAMINED. PANAMA, 119 specimens from: BOCAS DEL TORO PROV. - Almirante. CANAL ZONE - Barro Colorado Island; Black Tank Rd.; Cabima; Gatun (4 mi. W); Madden Forest; Mojinga Swamp; Paraiso; Pipeline Road; Skunk Hollow. COLLECTION DATES: Every month of the year.

OTHER COUNTRIES, 7 specimens from: TRINIDAD (same or very close species).

REMARKS. The opaque or dull elytra will usually distinguish the species from others occurring in Panama.

This species has been recorded from light traps, forest floor leaf litter, fermented palm fruits, and polypore fungi; lizard, rat, and opossum carrion; and from coati, howler monkey, human, spider monkey, tapir, and toad feces.

On Barro Colorado Island, A. candezei is active nocturnally, particularly during the period of 2200 to 0600 hours. It is most abundant in the wet season, when it is equally common on both carrion and dung; in the dry season it is found only on fecal material.

Distribution is seemingly restricted to lowland moist forests.

2. Ateuchus aeneomicans (Harold)

Fig. 120

Choeridium aeneomicans Harold, 1868, p. 82.

Type or cotype, Paris. Not seen.

Length 4.5 to 5.6 mm. Dorsally shining, dark green to dark brown or black with strong green or golden cast. Clypeal margin anteriorly shallowly, broadly emarginate, tooth on each side feebly developed to obsolete; margin lateral to each tooth evenly arcuate; clypeal disc (Fig. 120) with closely spaced small to moderate sized punctures. Frons and vertex feebly tumid, minutely punctate; eye dorsally narrow. Pronotum largely impunctate, smooth and shining, scattered minute punctures present laterally. Elytral striae feebly impressed, punctures in striae small to obsolete; intervals mostly smooth and shining, sometimes minutely punctate. Pygidium shining, with scattered minute punctures. Fore tibia with three teeth on outer margin; fore tibial spur of males broad, parallel sided, apical edge asymmetrically emarginate; fore tibial spur of female slender, parallel sided to slightly expanded, truncate apex.

MATERIAL EXAMINED. PANAMA, 42 specimens from: CANAL ZONE - Barro Colorado Island; Gamboa; Rio Ciricito. CHIRIQUI PROV. - Bugaba; Volcan de Chiriqui. COCLE PROV. - El Valle. COLON PROV. - Portobelo. PANAMA PROV. - Cerro Campana. COLLECTION DATES: January, February, March, June, October, November, December.

OTHER COUNTRIES, None.

REMARKS. The scarcely impressed elytral striae and the similarly colored green or golden pronotum and elytra will normally distinguish the species.

Specimens have been taken on tapir and Ateles dung.

3. Ateuchus (near?) guatemalensis (Bates)

Fig. 121

Choeridium guatemalense Bates, 1887, p. 45.

Cotypes, London and Paris. London specimens examined.

Length 4.1 to 5.6 mm. Dorsally shining dark brown to black, head and pronotum frequently with cupreous or slight greenish cast, elytra usually shining black. Clypeal margin anteriorly V-shaped, the emargination slightly wider in male, tooth on each side (both sexes) obtusely rounded, margin laterally arcuate from base of tooth; disc of clypeus (Fig. 121) punctate near margin (male) or mostly punctate (female). Frons and vertex broadly convex, surface smooth to minutely punctate; eye dorsally narrow. Pronotum shining, smooth or with widely scattered, minute punctures. Elytral striae distinctly impressed, with small, widely spaced or irregularly spaced punctures; intervals feebly convex, smooth and shining. Pygidium with basal groove just anterior to posterior marginal bead; pygidial surface smooth and shining. Fore tibia with four teeth on outer margin, the basal tooth feebly developed (may be lost in worn specimens); fore tibial spur in male broadly, irregularly lobed; in female slender, elongate, almost parallel sided to truncate apex.

MATERIAL EXAMINED. PANAMA, 160 specimens from: CANAL ZONE - Barro Colorado Island; Madden Dam; Paraiso. COLON PROV. - Coco Solo; Santa Rita Ridge. COLLECTION DATES: Every month of the year.

OTHER COUNTRIES, 2 specimens (of nominate form) from: GUATEMALA.

REMARKS. Assigning the name guatemalensis to the Panama population as described above is questionable, since the Panamanian form is smaller and may differ significantly in other respects. However, at present, introducing a new name in the genus, until it is revised, seems an even worse procedure.

This species has been obtained at tree sap; in forest floor leaf litter; at rat carcasses; and on coati, howler monkey, human, peccary, spider monkey, and tapir feces.

Ateuchus guatemalensis on Barro Colorado Island is diurnally active and most abundant in the dry season, when it is found only on fecal material. Individuals captured in the wet season are likely to be found on carrion.

The favored habitat seems to be the lowland moist forest of central Panama.

Canthidium Erichson

Canthidium Erichson, 1847, p. 109; Bates, 1887, p. 47.

Type-species: *Canthidium lentum* Erichson, designated by Lucas, 1920.

Neocanthidium Martínez, Halffter and Pereira, 1964, p. 166. NEW SYNONYMY.

Type-species: *Neocanthidium bokermanni* Martínez, Halffter and Pereira, by original designation.

Small to moderate (3 to 11 mm) in size, oval to almost circular in outline. Clypeus feebly to distinctly bidentate, in some species quadridentate. Frons flat or transversely carinate between lateral tubercles or with two or three distinctly separate conical tubercles. Pronotum lacking horns or anterior indentations, evenly convex; lateral pronotal fovea small, often circular, sometimes obsolete. Scutellum not visible. Elytron with eight striae on disc, the striae often feebly impressed or obsolete. Mesosternum narrow, transverse. Fore tibia with three distinct teeth on outer margin. Middle and hind tibiae apically expanded, tibiae lacking transverse carinae. Basal segment of hind tarsus two or more times as long as adjacent segment.

The genus *Neocanthidium* is treated herein as a synonym of *Canthidium*. The major distinguishing character supposedly separating *Neocanthidium* from *Canthidium* is a row of punctures across the base of the pronotum. All degrees of variation from large to small to no punctures are present in the various Panamanian species and none of the characters mentioned by Martínez, Halffter and Pereira (1964) seems to consistently separate a group of species from the genus *Canthidium* as defined by Harold.

The main characters distinguishing *Canthidium* as defined herein are the very narrow (measured *longitudinally*) mesosternum and the long basal segment of the hind tarsus. Other combinations of characters could form a variety of groups, but if this were done the groups formed would probably not represent monophyletic lines. Some of the sexual characters of *Canthidium* illustrate this. All males in the genus have the last abdominal sternite adjacent to the pygidium narrowed medially. However, many males also have the fore tibia modified in several ways. In some species the fore tibial spur is slightly shorter than in the female, but in general there is little sexual modification. Other males have the fore tibial spur flattened, expanded apically and often with the apex shallowly emarginate. This type of modification also occurs in *Ateuchus* and some other genera. The fore tibia of *Canthidium* itself may be modified by having the inner apical angle produced into an acute lobe, similar in this to some males in *Onthophagus*. Other males may have a distinct tuft of setae at the base of the tibial spur, in this case the spur is usually not modified. A similar modification, *i.e.*, tuft of setae, occurs in some groups of *Onthophagus*. Within *Canthidium* the various tibial modifications can occur in different combinations in the males of different species, with seemingly closely related species having quite different combinations. Thus, any generic groupings based on the external modifications of the male fore tibia would be an arbitrary and artificial classification.

The genus is a large one and is mainly, if not entirely, confined to areas of heavy forest in the tropical and subtropical areas of the New World.

Key to species of *Canthidium*

1. Clypeal-frontal region with two or three conical tubercles, at least one always with shining, angulate apex; surface sometimes carinate between tubercles 2
   Clypeal-frontal region lacking tubercles or with one to three feebly elevated, broadly rounded swellings, these not distinctly angulate at apex 10

2. Pygidium with distinct, well defined (at least in basal half) punctures, the punctures separated by approximately one diameter 3
   Pygidium impunctate or with minute, inconspicuous punctures 4

3. Clypeal-frontal region with two tubercles connected by low transverse carina; average body length 7 mm . . . . 4. *angusticeps* Bates
   Clypeal-frontal region with three tubercles, surface not carinate between; average body length 4.5 mm . . . . 17. *aurifex* Bates

4. Pronotum narrowly impressed along posterior margin anterior to elytra, the impression with single row of punctures, punctures often elongate; average body length over 5 mm 5
   Pronotum not impressed adjacent to posterior margin, lacking transverse row of punctures adjacent to margin; average body length 4.0 to 5.5 mm 7

5. Clypeus with anterior median edge with distinct V-shaped emargination; frons not elevated between clypeal-frontal tubercles; average body length 6 mm 6

Clypeus with anterior median edge broadly, shallowly emarginate; frons elevated between the two clypeal-frontal tubercles; average body length 8 mm . . . . 3. *haroldi* Preud.

6. Two frontal tubercles strongly developed, pointed; pronotum tan, head and elytra brown to black; elytral striae strongly impressed (for genus) . . . . 6. *bituberifrons* n. sp.

Two frontal tubercles feebly developed, scarcely elevated (the species also keyed in second portion of first couplet); head and pronotum brown to dark brown, cupreous, elytra similar or lighter in color; elytral striae moderately impressed . . . . . 5. *elegantulum* Balth. (in part)

7. Elytral striae fine, scarcely impressed, feebly punctate or impunctate; pygidial surface of males mostly smooth and shining, medially flat or convex 8

Elytral striae impressed, distinctly punctate; pygidial surface of males granular, dull, medially often with shallow concavity; average body length 5.5 mm . . . . . . 7. *discopygidiale* n. sp.

8. Elytra lacking metallic sheen, usually of different color than pronotum 9

Elytra with cupreous or greenish cast, similar in color to pronotum; average body length 4.5 mm . . . . 16. *ardens* Bates (in part)

9. Clypeus medially with V-shaped emargination between tooth on each side, a rounded, shallow emargination at outer margin of each tooth, the clypeal margin often appearing almost quadridentate; elytra dark brown to black, frequently with tan spots or rarely each elytron tan except in anterior lateral half and along margins; average body length 4.5 mm . . . . 14. *variolosum* n. sp.

Clypeus with moderately broad V-shaped emargination between teeth, lateral emargination lacking, the clypeus appearing simply bidentate, the outer margin arcuate; elytron ivory to tan, suture and lateral margin narrowly black; average body length 4 mm . . 15. *leucopterum* n. sp.

10. Pronotum posteriorly with transverse row of punctures immediately adjacent to margin anterior to elytra 11

Pronotum posteriorly lacking transverse row of punctures adjacent to margin 13

11. Clypeal teeth obtuse, emargination between broadly V-shaped; color dorsally uniform brown or black, lacking distinct metallic reflections; size normally more than 7 mm 12

Clypeal teeth acute, emargination between narrowly V-shaped; color dorsally brown to dark brown, elytra often lighter; head and pronotum often with cupreous or green cast; average body length 6 mm . . . . .5. *elegantulum* Balth. (in part)

12. Eye dorsally at posterior inner edge of canthus constricted, four to six facets wide; hind tibia with inner narrow edge straight to arcuate, not distinctly sinuate; frons distinctly tumid; average body length 8 mm . . . 2. *tuberifrons* n. sp.

Eye dorsally at posterior inner edge of canthus not constricted, more than 10 facets wide; hind tibia with inner margin feebly (female) to distinctly (male) sinuate; frons feebly tumid; average body length 9.5 mm . . . .1. *centrale* Bouc.

13. Eye dorsally at posterior edge of canthus constricted, three to six facets wide 15

Eye dorsally at posterior edge of canthus not constricted, 10 or more facets wide 14

14. Elytral striae distinctly punctate; pygidial length to width ratio 2.5:4.5; average body length 4.8 mm . . . . 12. *vespertinum* n. sp.

Elytral striae impunctate or nearly so; pygidial length to width ratio 3.5:5.5; average body length 4.5 mm . . . . 10. *planovultum* n. sp.

15. Pygidium impunctate or minutely punctate; surface usually shining, faintly shagreened, finely granular, or smooth between punctures . . 16

Pygidium with moderate sized punctures; surface dull, granular; body length 4.9 mm. . . . . 8. *subdopuncticolle* n. sp.

16. Elytra at most only slightly different in color to pronotum, brown or black, frequently with cupreous or green cast 17

Elytra distinctly lighter in color than pronotum; elytra ivory to tan, pronotum dark brown or black with slight metallic sheen; average body length 4.5 mm . . . . 13. *pallidoalatum* n. sp.

17. Elytra surface largely shining, intervals often minutely punctate, surface between punctures smooth, not granular 18
Elytra dull, intervals very feebly punctate or impunctate, surface distinctly granular; average body length 5 mm . . . . . . .9. *tenebrosum* n. sp.

18. Strial lines on elytral disc lacking distinct punctures 19
Strial lines on elytral disc distinctly punctate; average body length 4.3 mm . . . . 11. *perceptibile* n. sp.

19. Metasternum between middle coxae smooth or at most minutely punctate; average body length 4 mm . . . . 16. *ardens* Bates (in part)
Metasternum between middle coxae with scattered small but distinct punctures; average body length 3.8 mm . . . . 18. *hespenheidei* n. sp.

1. *Canthidium centrale* Boucomont

Figs. 122–125

Canthidium centrale Boucomont, 1928, p. 203.
Cotype, Paris. Not seen.

Length 8.5 to 10.0 mm. Dorsal color black, occasionally brown (teneral specimens); pronotal disc and elytral intervals very minutely punctate and slightly alutaceous, head dorsally more distinctly, closely punctate. Clypeus (Fig. 122) feebly bidentate, median emargination with shallow, very broad V-shaped emargination; margin laterally on each side evenly arcuate to middle of gena. Disc of clypeus nearly flat; frons broadly, feebly tumid, tubercles or distinct swellings lacking. Eye dorsally at posterior end of gena broad, 15 or more facets wide. Pronotum evenly, broadly convex, lateral foveae obsolete, posterior margin lacking adjacent transverse indentation but with contiguous row of small, elongate punctures, these absent at and near midline. Elytra with strial lines distinctly indented and punctate, punctures separated by three to five diameters; intervals convex. Pygidium with scattered fine punctures, punctures closer in basal third. Fore femur posteriorly with partly double, irregular longitudinal row of setose punctures, remainder of surface smooth; middle and hind femora with ventral surfaces smooth, impunctate. Fore tibial spur of male (Fig. 123) slightly stouter and with more rounded apex than in female; also in male a small basal tuft of setae present adjacent to spur. Hind tibia of males with inner edge strongly sinuate in basal half; in females the sinuate inner margin feebly expressed or absent. Male genitalia as in figs. 124, 125.

MATERIAL EXAMINED. PANAMA, 39 specimens from: CANAL ZONE - Barro Colorado Island; Madden Forest. PANAMA PROV. - Cerro Campana. COLLECTION DATES: January, February, March, May, July, August, September, November, December.

OTHER COUNTRIES, 32 specimens from: MEXICO, GUATEMALA, ECUADOR.

REMARKS. The elytral intervals of the Ecuadorian specimens are dull or opaque, whereas in the Central American and Mexican specimens the intervals are shining.

This species has been collected in light traps; in forest floor leaf litter; at rat carrion; and on human and tapir feces. Canthidium centrale is nocturnally active and during the day can be found in leaf litter.

2. Canthidium tuberifrons n. sp.

Figs. 126-129

HOLOTYPE. Male, length 8.6 mm, greatest width 5.3 mm. Dorsally dark brown, pronotal disc and elytral intervals very minutely punctate or impunctate, distinctly alutaceous. Clypeus (Fig. 126) bidentate, median emargination V-shaped, margin on each side evenly arcuate to middle of gena; clypeal surface in anterior half closely, contiguously punctate; posterior half distinctly, broadly tumid, the tumid area minutely punctate; frons and vertex just posterior to tumosity shallowly concave, finely punctate. Eye at posterior end of gena narrow, five facets wide. Pronotum broadly convex, lateral foveae obsolete, posterior margin (Fig. 127) with adjacent transverse depressed area, a line of distinctly elongate punctures present in depression contiguous with margin, punctures obsolete at midline. Elytra with striae distinctly indented and punctate; punctures in each stria separated by from two to five diameters; intervals convex. Pygidium with small punctures present in basal third. Fore femur with irregular double row of setose punctures on posterior (ventral) surface; middle and hind femora with ventral surfaces smooth, impunctate. Fore tibial spur slightly thicker than in female, otherwise unmodified, a small basal tuft of setae present. Hind tibia with inner margin evenly, inwardly curved, not sinuate. Genitalia as in figs. 128, 129.

ALLOTYPE. Female, length 7.5 mm, greatest width 4.7 mm. Dorsally black. Differing from holotype in the following major characters: anterior half of clypeal disc closely punctate and feebly transversely rugose; pygidium less punctate; fore tibial spur more slender, only three or four setae present at base of spur.

TYPE MATERIAL: Holotype, male, Panama, Chiriqui Prov., 1500 m, 15 km NW Hato del Volcan, Hartmann's Finca, 20-31.V. 1977, S. Peck, dung traps 4-6 (Howden). Allotype, female, same locality as holotype, 8°51'N, 82°46'W, 24-25.V.1977, H. & A. Howden, cup trap in ravine (Howden).

PARATYPES: 7 males, 14 females. PANAMA: 5 males, 12 females, same data as allotype except 30-31.V.1977; 1 male, Cocle Prov., trib. Rio Guayabo, El Valle, 2200', 24.II.1959, H.S. Dybas, in horse manure; 1 male, 2 females, Panama Prov., Cerro Campana, 800 m (3000'), 30.VII.1970, H. & A. Howden, on feces, 5.IX.1970, H.P. Stockwell, human manure trap, 22.V.1976, B.C. Ratcliffe, at black light.

Paratypes are in: Chicago, Ottawa, Washington, Howden, Ratcliffe.

REMARKS. Size varies from 7.0 to 9.5 mm; also the degree of convexity of the frons varies, often being more pronounced in larger specimens. Canthidium tuberifrons is seemingly related to a complex of species, including C. convexifrons Balthasar, that ranges from Mexico to Argentina. In the case of convexifrons from Colombia, the species is smaller and dorsally distinctly smoother and more shining than is tuberifrons.

3. Canthidium haroldi Preudhomme

Figs. 130–133

Canthidium haroldi Preudhomme de Borre, 1886, p. 111; Bates, 1887, p. 47.

Type, Geneva (?). Not seen.

Length 6.1 to 10.0 mm. Dorsally shining reddish brown to black with strong green or cupreous reflections; pronotal disc and elytral intervals mostly smooth, very feebly, minutely punctate. Clypeus (Fig. 130) feebly bidentate, median emargination shallow, broadly V-shaped; margin on either side evenly arcuate to middle of gena; clypeal frontal juncture elevated, tuberculate at each end, the two tubercles separated by approximately same distance as clypeal teeth; surface of head, excluding tuberculate area, moderately, closely punctate. Eye dorsally at posterior end of gena narrow, four to seven facets wide. Pronotum with lateral fovea small, circular, sometimes obsolete; area immediately adjacent to posterior margin indented and with single row of longitudinally elongate punctures. Elytral striae represented by finely indented lines, faint punctures present in strial lines, punctures separated by 8 to 10 diameters or more; intervals almost flat. Pygidium shining, finely punctate and shagreened. Posterior surface of fore femur with longitudinal, irregular row of large, setose punctures in males, the setose punctures present but small in females; middle and hind femora with ventral surface minutely punctate and shagreened. Fore tibial spur of male (Fig. 131) not greatly modified, cylindrical, and with acutely pointed apex; tuft of setae present at inner base of spur; tuft lacking in female. Male genitalia as in figs. 131, 132.

MATERIAL EXAMINED. PANAMA, 164 specimens from: CANAL ZONE - Barro Colorado Island; Canoa Saddles; Curundu; Fort San Lorenzo; Madden Forest. CHIRIQUI PROV. - Bugaba. PANAMA PROV. - Cerro Azul; Cerro Campana; Cerro Jefe. COLLECTION DATES: Every month of the year.

OTHER COUNTRIES, 24 specimens from: GUATEMALA, COSTA RICA, ECUADOR.

REMARKS. Specimens from Ecuador have the pronotum consistently more distinctly punctate and the dorsal surface less shining. This species has been captured perching on leaf surfaces; in forest floor leaf litter; at rat carrion; and on coati, howler monkey, human, opossum, and tapir feces.

On Barro Colorado Island haroldi is active throughout the day, particularly during the periods of 0600 to 1000 hours and from 1500 to 1800 hours. The species is most abundant during the late wet season.

4. Canthidium angusticeps Bates

Figs. 134-136

Canthidium angusticeps Bates, 1887, p. 49.

Cotypes, London and Paris. London specimens examined.

Length 6.9 to 8.1 mm. Head and pronotum reddish cupreous, finely punctate; elytra brownish black to black with cupreous reflections; intervals minutely punctate, smooth between punctures. Clypeus (Fig. 134) distinctly bidentate, median emargination deeply U-shaped, clypeus broadly, shallowly concave to margin; margin on each side in conjunction with margin of gena unevenly sinuate. Frons transversely carinate, the carina raised at each end, essentially bituberculate with carina connecting the tubercles. Eye dorsally at posterior end of gena narrow, five to seven facets wide. Pronotum evenly convex except for small, circular lateral fovea on each side; posterior edge of pronotum with transverse row of moderate sized, circular punctures, the row of punctures not in transverse groove. Elytra with striae represented by feebly indented lines interrupted by large shallow punctures separated by three to five diameters; intervals nearly flat, minutely punctate. Pygidium distinctly punctate, punctures separated by approximately one diameter. Posterior surface of fore femur with scattered coarse, setose punctures; middle and hind femora ventrally each with elongate, fine punctures paralleling long axis of femora. Fore tibial spur of male bluntly acute. Male genitalia as in figs. 135, 136.

MATERIAL EXAMINED. PANAMA, 3 specimens from: CANAL ZONE - near Fort San Lorenzo, 20 m. PANAMA PROV. - Cerro Campana, 850 m. COLLECTION DATES: April, August, October.

OTHER COUNTRIES, 5 specimens from: COSTA RICA, COLOMBIA.

REMARKS. The Colombian specimen from Anchicaya, 70 km E of Buenaventura, has more heavily punctate elytral striae than Panamanian specimens. This difference may indicate a sibling species but more material is needed. A very closely related species (?) occurs at Limoncocha, Napo Prov., Ecuador. There appears to be in South America a widespread complex of forms or species related to angusticeps.

Specimens were taken in traps baited with human feces.

5. Canthidium elegantulum Balthasar

Figs. 137-140

Canthidium elegantulum Balthasar, 1939c, p. 121.

Type, Prague. Examined.

Length 5.5 to 6.5 mm. Color dorsally tan or brown or reddish brown, often with cupreous cast; elytra frequently lighter in color than pronotum; surface of head, pronotal disc and elytral intervals smooth to minutely punctate, strongly shining. Clypeus (Fig. 137) distinctly bidentate, sharply V-shaped between teeth, shallowly emarginate on each side adjacent to tooth, margin then evenly arcuate posteriorly to middle of gena; clypeal disc shallowly concave. Frons tumid; a feeble, sometimes obsolete, tubercle present on each side near inner junction of clypeus and gena. Eye dorsally at posterior end of gena very narrow, two or three facets wide. Vertex nearly flat medially, surface smooth, minutely punctate. Pronotum with shallow lateral fovea, a narrow band contiguous to posterior margin feebly indented, indentation (Fig. 138) with row of shallow oval to circular punctures. Elytra with striae represented by feebly indented lines interrupted by widely spaced shallow punctures, punctures usually separated by more than six diameters; intervals feebly convex. Pygidial surface minutely punctate, a few coarse punctures in basal groove. Posterior surface of fore femur with a few scattered, coarse, setose punctures; middle and hind femora ventrally with scattered very minute punctures or surface impunctate. Fore tibial spur of male tapered to acute apex, similar to female in this respect, but with tuft of setae at base of spur that is lacking in female. Male genitalia as in figs. 139, 140.

MATERIAL EXAMINED. PANAMA, 99 specimens from: CANAL ZONE - Barro Colorado Island; Gatun; Madden Forest; Pipeline Road; Rio Ciricito; Skunk Hollow; Tabernilla. PANAMA PROV. - Cerro Campana; Rio Pequeni. COLLECTION DATES: Every month of the year.

OTHER COUNTRIES, None.

REMARKS. This species has been found sitting on leaves; in forest floor leaf litter; in and on rotting fig fruit on the ground; under an old coati carcass; and at bat, howler monkey, tapir, tayra, and human feces.

On Barro Colorado Island elegantulum is present throughout the year but is most common during the middle of the rainy season. Diurnally active, it is most frequent from 0900 to 1500 hours. The species is seemingly restricted to the lowland forests of central Panama.

6. Canthidium bituberifrons n. sp.

Figs. 141-143

HOLOTYPE. Male, length 5.3 mm, greatest width 3.7 mm. Head dorsally largely shining black with greenish reflections; pronotum shining yellowish tan; elytra shining dark reddish brown to black; head, pronotal disc and elytral intervals smooth or very finely shagreened and minutely punctate. Clypeus (Fig. 141) strongly bidentate, median emargination abruptly U-shaped; margin laterally evenly arcuate to middle of gena. Frons near inner anterior margin of each eye with strongly elevated, conical tubercle, the area between feebly concave; dorsal surface of head smooth; eye dorsally at posterior end of gena narrow, five to eight facets wide. Pronotum evenly convex, lateral fovea small, indistinct;

narrow band immediately adjacent to posterior margin (essentially marginal line) with row of small, circular or oval punctures, these slightly larger and somewhat anterior to margin near (posterior) midline basally. Elytra with strial lines distinctly impressed, each line distinctly punctate, the punctures separated by four to six diameters; elytral intervals feebly convex, more distinctly so near apices. Pygidium mostly smooth and shining. Posterior surface of fore femur with longitudinal irregular row of small setigerous punctures, surface otherwise finely shagreened; middle and hind femora ventrally minutely punctate and finely shagreened. Fore tibia with spur slightly expanded, flattened and curved downward in apical third, apex rounded; inner edge of tibia at base of spine feebly produced and with small tuft of setae. Male genitalia as in figs. 142, 143.

ALLOTYPE. Female, length 5.5 mm, greatest width 3.5 mm. Differing from holotype in the following major characters: apical sternite distinctly broader, of uniform width (as is normal in females); apical tibial spur narrower apically; tibia lacking apical tuft of setae.

TYPE MATERIAL: Holotype, male, Panama, Panama Prov., Cerro Campana, 3000 ft., 30.VII.1970, H. & A. Howden, on human feces (Howden). Allotype, female, same locality as holotype, 27. V.1974, O.P. Young, on howler monkey feces (USNM).

PARATYPES: 1 male, 1 female. PANAMA: 1 male, same locality as holotype, 30.VII.1974, H. Stockwell (Howden); 1 female, Panama Prov., Cerro Campana, 850 m, 8°40'N, 79°56'W, 21 Aug. 1971, W.R. Bivin (E.G. Riley).

REMARKS. The paratypes do not vary noticeably. The sharply bituberculate frons, yellowish tan pronotum, the nearly black head and elytra, and the impressed elytral striae should distinguish this species from other species occurring in Panama.

7. Canthidium discopygidiale n. sp.

Figs. 144-146

HOLOTYPE. Male, length 5.0 mm, greatest width 3.7 mm. Dorsally dark brownish black, pronotum light brown, head and pronotum with cupreous reflections; pronotal disc and elytral intervals shining, smooth to very minutely punctate. Clypeus (Fig. 144) feebly bidentate, median emargination shallowly U-shaped, clypeal margin laterally very slightly sinuate at junction with gena; clypeal-frontal area trituberculate, median conical tubercle anterior to and twice size of either lateral tubercle; dorsal surface of head moderately, closely punctate, more densely so on clypeus. Eye dorsally almost enclosed posteriorly by posterior edge of gena, at most one or two facets wide at constriction. Pronotum with circular lateral fovea shallow, small; posterior pronotal margin lacking adjacent indentation or row of punctures. Elytra with strial lines moderately to strongly impressed and coarsely punctate, punctures in most striae separated by two to three diameters, intervals feebly convex, minutely punctate. Pygidial surface dull, granular, surface centrally at basal third shallowly concave. Posterior surface of fore femur with three or four large setose punctures in apical half, remainder nearly smooth; middle and hind femora ventrally very finely punctate and shagreened. Fore tibia with apical spur broadly expanded to almost truncate or feebly emarginate apex; tuft of setae lacking at base of spur. Genitalia as in figs. 145, 146.

ALLOTYPE. Female, length 4.9 mm, greatest width 3.7 mm. Differing from holotype in the following major characters: clypeus more distinctly punctate, partly transversely rugose; pygidium shining, minutely punctate, lacking central shallow cavity, the pygidium evenly convex; fore tibial spur relatively slender, slightly tapered to anteriorly rounded apex.

TYPE MATERIAL: Holotype, male, Panama, Panama Prov., Cerro Campana, 3000 ft., 8°40'N, 79°56'W, 1.VIII.1970, H. & A. Howden (Howden). Allotype, female, same locality as holotype, 10.II.1973, H. Stockwell (Washington).

PARATYPES: 6 males, 6 females. PANAMA: 1 male, 1 female, same locality as holotype, 28.IV.1973, H. Hespenheide, 13.V.1973, H. Stockwell; 2 males, 3 females, Canal Zone, Fort Kobbe, 6-24 June 1976, E.G. Riley. COSTA RICA: 3 males, 1 female, Puntarenas Prov., 1400 m, 1500 m, Monteverde, 23,24.V.-3.VI.1979, H. & A. Howden, (males) cup traps, (female) sitting on leaf; 1 female, Puntarenas Prov., Osa Peninsula near Rincon, 8°42'N, 83°28'W, 23.I.1968, H. Hespenheide.

Paratypes are in: Washington, Howden, Riley.

REMARKS. Variation occurs primarily in color, the pronotum of both the holotype and allotype being reddish tan and the elytra being reddish brown. The male paratypes have the head, pronotum, and elytra black with a distinct cupreous cast. In other respects, except for the sexual difference as noted, the specimens are quite uniform.

8. Canthidium subdopuncticolle n. sp.

Figs. 147-149

HOLOTYPE. Male, length 4.9 mm, greatest width 2.8 mm. Dorsally dark brownish black with cupreous cast; pronotal disc shining, with numerous small to moderate sized shallow punctures; elytral intervals impunctate, alutaceous, feebly shining. Clypeus (Fig. 147) bidentate, each tooth rounded and separated medially from its opposite by a broad U-shaped emargination; margin laterally on each side sinuately curved to gena; surface of clypeus closely punctate and transversely rugose. Frons with two extremely vague swellings, one on each side midway between anterior edge of eye and midline, midline appearing slightly tumid at certain angles. Eye dorsally at posterior end of gena moderately narrowed, five to seven facets wide. Pronotum evenly convex; fovea on each side small, circular, shallow; posterior pronotal margin lacking adjacent transverse groove or row of elongate punctures. Elytral striae represented by slightly indented lines, lines lacking punctures or with vague punctures present in lateral striae. Pygidium with shallow, somewhat irregular, scattered punctures, pygidial surface distinctly granular, dull; pygidium one-sixth wider than long. Posterior surface of fore femur and ventral surfaces of middle and hind femora impunctate, alutaceous. Fore tibial spur not greatly modified, slender, relatively short (worn?), inner apical angle of tibia adjacent to spur produced and slightly bent downward, forming a broad, acutely angulate lobe approximately as long as tibial spur. Genitalia as in figs. 148, 149.

FEMALE. Unknown.

TYPE MATERIAL: Holotype, male, Panama, Canal Zone (= Colon Prov.), Alhajuela, 28.V.1912, A. Busck (Washington).

REMARKS. Initially we considered this species to be a small, odd specimen of *C. puncticolle* Har., but the two extremely vague tubercles on the head, cupreous color, shallowly punctate pronotum, obsolete strial punctures and genitalic characters seem to preclude the inclusion of the unique male under *puncticolle*. Actually *puncticolle* of authors seems to represent a complex of forms, some with two, some with three tubercles on the head. At present the closest form to *subdopuncticolle* is seemingly the blue variety mentioned by Bates (1887, p. 49) that occurs from Costa Rica to Mexico. This blue form is distinctly larger in size, the pronotum and elytral striae are more strongly punctate and the male genitalia differs in shape.

9. *Canthidium tenebrosum* n. sp.

Figs. 150-152

HOLOTYPE. Male, length 5.3 mm, greatest width 3.2 mm. Black, clypeus and elytra tinged with brown, legs brown; dorsally feebly shining; pronotum and, to lesser degree, elytral intervals minutely punctate, surface finely granular. Clypeus (Fig. 150) bidentate, median emargination broadly V-shaped, margin laterally evenly arcuate on each side to middle of gena except slightly notched at clypeal-genal junction; surface of clypeus feebly, transversely rugose. Frontal area feebly tumid, particularly just anterior to and inside inner edge of eye, a vague median tumosity also present (indicating relationship to other trituberculate species); frons and vertex moderately punctate, surface between punctures granulate. Eye dorsally at posterior end of gena narrowed, three to five facets wide. Pronotum moderately convex, lateral foveae small, circular, shallow; pronotal surface finely punctate, between punctures granular, dull. Elytral striae represented by feebly impressed lines, each line with shallowly impressed punctures, the punctures usually separated by four to six diameters; elytral intervals flat, obsoletely minutely punctate, granulate. Pygidium with scattered small to minute punctures, surface finely granular or shagreened, dull. Posterior surface of fore femur with two or three coarse, setose punctures near apex, remainder of surface shagreened and with scattered, very minute punctures. Ventral surfaces of middle and hind femora finely shagreened and with scattered minute punctures. Fore tibial spur not obviously modified, slightly shorter than in female; inner anterior angle of tibia adjacent to spur produced into acutely angled lobe; tuft of setae lacking. Genitalia as in figs. 151, 152.

ALLOTYPE. Female, length 5.4 mm, greatest width 3.2 mm. Similar to holotype except in the following characters: color dorsally with distinct greenish cast; clypeal margin laterally less strongly arcuate; pronotal surface only feebly granular, more shining; pygidial punctures greatly reduced; posterior surface of fore femur with four or five setose punctures near apex; fore tibia with inner apical angle not produced, not acute.

TYPE MATERIAL: Holotype, male, Panama, Chiriqui Prov., 2 km W Cerro Punta, Baldwin Forest, 3.VI.1977, H. Howden, cup trap (Howden). Allotype, female, Panama, Chiriqui Prov., 2 km W Cerro Punta, 8°51'N, 82°36'W, 22.V.1977, H. Howden, cup trap (Howden).

PARATYPES: 94 males, 129 females. PANAMA: 50 males, 80 females, same data as holotype; 17 males, 17 females, same data as allotype; 9 males, 7 females, Chiriqui Prov., Cerro Punta, 1500 m, 23.V.1977, H. Howden, cup traps; 4 males, 7 females, Chiriqui Prov., 2 km W Cerro Punta, 1760 m, Baldwin Forest, 30. V.-8.VI.1977, S. Peck, dung trap; 2 males, 4 females, Chiriqui Prov., 2-3.X.1975, O.P. Young, tapir feces, rat carcass trap; 2 males, 2 females, Chiriqui Prov., 2.5 km W Cerro Punta, 8°51'N, 82°36'W, 1720 m, 28.XI.1975, H.P. Stockwell, manure trap. COSTA RICA: 1 male, Alajuela Prov., Volcan Poas, Poacito, 1840 m, 20. VII.-3.VIII.1960, S. Peck, carrion trap; 9 males, 12 females, Puntarenas Prov., Monteverde Reserve, 1500 m, 27.V-1.VI.1979, H. & A. Howden, cup traps and large dung trap.

Paratypes are in all collections studied.

REMARKS. The large series on hand varies in length from 4.0 to 5.5 mm. The majority of specimens are dark brown to black, but a number of specimens, particularly females, may have a cupreous or greenish cast. All specimens, unless worn, are dorsally granular, the surface, at most, feebly shining. The degree of rugosity of the clypeus varies, in some specimens the clypeal surface is more contiguously punctate than rugose. The tumosity of the frons also varies, but none of the specimens seen have the frons distinctly trituberculate (or tuberculate). The spacing of the punctures on the pronotum, on the elytral striae and elsewhere, shows some variation, but does so within a relatively narrow range.

The relatively dull pygidium might cause some specimens to be keyed out as _subdopuncticolle_, but the rather elongate body shape of _tenebrosum_ should separate it from the _puncticolle_ group.

10. _Canthidium_ _planovultum_ n. sp.

Figs. 153-155

HOLOTYPE. Male, length 4.6 mm, greatest width 3.0 mm. Color dorsally black with head and lateral margins of pronotum brownish black; head and pronotum finely, distinctly punctate; elytral intervals irregularly, indistinctly punctate. Clypeus (Fig. 153) feebly bidentate, median emargination shallow, U-shaped;

clypeal margin on either side more abruptly curved near junctions of gena, the curve nearly uniform to middle of gena. Clypeal-frontal area very slightly tumid, entire surface of head closely punctate, anterior half of clypeus contiguously punctate or transversely rugose. Eye dorsally at posterior end of gena broad, 12 to 13 facets wide. Pronotum broadly convex, lateral foveae obsolete, posterior edge of pronotum lacking adjacent elongate punctures or transverse depression. Elytral striae faint to obsolete, lacking distinct punctures; intervals flat, finely punctate, the punctures irregular in size and shape, giving surface irregular appearance. Pygidium large for genus, approximately 1.2 mm wide, surface with widely scattered small punctures, the area between smooth and shining. Posterior surface of fore femur and ventral surfaces of middle and hind femora with scattered minute punctures and finely, longitudinally alutaceous. Fore tibial spur slightly thickened but not noticeably dissimilar from female, inner apical margin of tibia at base of spur deflected downward and extended to form a broad, acute lobe. Male genitalia as in figs. 154, 155.

ALLOTYPE. Female, length 4.4 mm, greatest width 2.9 mm. Different from male in the following major characters: pygidium with surface slightly irregular, less distinctly punctate; apex of fore tibia not forming a broad, distinctly enlarged lobe but still slightly produced, forming an acute angle, this character being unusual in females of the genus.

TYPE MATERIAL: Holotype, male, Panama, Chiriqui Prov., 2 km W Cerro Punta, 1300 m, 8°51'N, 82°36'W, 27.V.1977, H. Howden, cup trap (Howden). Allotype, female, Panama, Chiriqui Prov., 2 km W Cerro Punta, Baldwin Forest, 3.VI.1977, H. & A. Howden, cup trap (Howden).

PARATYPES: 89 males, 131 females. PANAMA: 60 males, 70 females, same data as holotype; 14 males, 26 females, same locality as allotype, 30.V.-8.VI.1977, S. Peck, mega dung traps; 8 males, 16 females, same locality as holotype, 22.V.-3.VI.1977, H. & A. Howden, cup traps; 2 males, Chiriqui Prov., Cerro Punta, 1500 m, 23.V.1977, H. Howden, cup traps; 4 males, 10 females, Chiriqui Prov., 2-3.X.1975, O.P. Young, tapir feces trap, rat carcass trap; 9 females, Chiriqui Prov., 2.5 km W Cerro Punta, Audubon cabin, 28.XI.1975, H. Stockwell, 19.V.1977, S. & J. Peck. COSTA RICA: 1 male, Alajuela Prov., Volcan Poas, Poacito, 1840 m, 20.VII.-3.VIII.1960, S. Peck, carrion trap.

OTHER SPECIMENS: One male, Mexico, Oaxaca, 20 mi S Juchatengo, 6000 ft., 27-30.V.1971, S. Peck (apparently the same species but differs slightly in punctures on fore tibia and clypeus).

Paratypes are in all collections studied.

REMARKS. Considering the large series of planovultum on hand, the species is remarkably uniform, varying moderately in size from 3.9 to 4.9 mm. The oval form, distinct convexity, and dark brown to black color gives the species a fairly distinctive appearance. However, for initial recognition, the characters as outlined in the key should be utilized.

11. Canthidium perceptibile n. sp.

Figs. 156-158

HOLOTYPE. Male, length 4.3 mm, greatest width 2.6 mm. Dorsally shining, dark brownish black with strong cupreous and greenish reflections; pronotum and, to lesser degree, elytral intervals minutely punctate. Clypeus (Fig. 156) bidentate, median emargination V-shaped; margin laterally feebly arcuate to slightly notched junction with gena; clypeal surface transversely rugose. Frons on either side and anterior to eye with feeble tumosity indicating tubercle, however frons definitely not tuberculate; surface closely punctate. Eye dorsally at posterior end of gena narrow, three to five facets wide. Pronotum moderately convex, lateral foveae small, circular, concave. Elytron with strial lines feebly impressed, each line distinctly punctate, the punctures separated by approximately five or six diameters; intervals nearly flat, surface minutely punctate or faintly irregular, polished and shining. Pygidium with scattered small punctures, surface between mostly smooth and shining. Posterior surface of fore femur with one or two setose punctures near apex, remainder of surface minutely punctate and longitudinally shagreened. Ventral surface of middle and hind femora minutely punctate and longitudinally shagreened. Apical spur of fore tibia long and slender, apex acute; adjacent inner angle of tibia narrowly, anteriorly produced, forming sharp, acute lobe approximately half the length of spur; tibia lacking apical tuft of setae. Male genitalia as in figs. 157, 158.

ALLOTYPE. Female, length 4.5 mm, greatest width 3.0 mm. Dorsally shining, bluish green to black. Differing from holotype in the following major characters: clypeus more rugose; elytral striae less strongly punctate; fore tibial spur slightly larger, more slender; fore tibial teeth less acute.

TYPE MATERIAL: Holotype, male, Panama, Chiriqui Prov., 2 km N Sta. Clara, 1300 m, 8°51'N, 82°46'W, Hartmann's Finca, 24-25.V.1977, H. & A. Howden (Howden). Allotype, female, Costa Rica, Puntarenas, Monteverde, 1500 m, 23.V.1979, H. & A. Howden (Howden).

PARATYPES: 8 males, 11 females. PANAMA: 1 male, same locality as holotype, 30-31.V.1977, H. & A. Howden, in cup trap baited with human feces; COSTA RICA: 7 males, 11 females, Puntarenas, Monteverde, 1400 m, and Reserve, 1100 m, 27-31.V. 1971, H. & A. Howden, cup trap, sitting on leaves.

Paratypes are in: Ottawa, Washington, Howden.

REMARKS. The few specimens exhibit no noteworthy variation. The species may be confused either with C. aurifex or C. ardens because of its shining cupreous or greenish dorsum but can be separated from either of these species by the following combination of characters: non-tuberculate frons, elytral strial lines distinctly punctate, fore tibial spur of male slender and apex of male genitalia ridged (Fig. 158). The ridged apex of the genitalia is similar to that of tenebrosum but perceptibile has the elytral intervals shining rather than opaque.

12. *Canthidium vespertinum* n. sp.

Figs. 159-161

HOLOTYPE. Male, length 4.6 mm, greatest width 3.0 mm. Dorsally very dark brownish black, head and pronotum with slight cupreous tinge; pronotal disc and elytral intervals closely, finely punctate, punctures frequently separated by one diameter. Clypeus (Fig. 159) very feebly bidentate, median indentation extremely shallow, very obtusely V-shaped; margin laterally on each side evenly arcuate to middle of gena. Clypeal disc, frons and vertex in a single plane, nearly flat; tubercles or swellings lacking; surface finely punctate, more conspicuously so on clypeus. Eye dorsally at posterior end of gena broad, 15 or more facets wide. Pronotum broadly convex, lateral foveae obsolete; posterior pronotal margin lacking line of elongate punctures or associated transverse groove. Elytra with strial lines feebly impressed, distinctly punctate, the punctures separated by three to four diameters; elytral intervals flat. Pygidium minutely punctate, feebly alutaceous between punctures. Fore femur with posterior surface lacking setigerous punctures, only scattered minute punctures present, surface shining and polished. Middle and hind femora with ventral surface similar to posterior surface of fore femur. Fore tibia with tarsal spur unmodified, inner apical angle of fore tibia anteriorly forming acute tooth. Genitalia as in figs. 160, 161.

ALLOTYPE. Female, length 4.6 mm, greatest width 2.9 mm. Differing from male in the following major characters: dorsal surfaces slightly more shining and more distinctly punctate; pygidium less distinctly punctate; inner apical edge of fore tibia not produced, essentially right-angled.

TYPE MATERIAL: Holotype, male, Panama, Chiriqui Prov., 2 km N Sta. Clara, 1300 m, 8°51'N, 82°46'W, Hartmann's Finca, 24-25.V.1977, H. & A. Howden (Howden). Allotype, female, same data as holotype (Howden).

PARATYPES: 5 males, 4 females. PANAMA: 1 female, same locality as holotype, 20-31.V.1977, S. Peck, dung trap, human feces. COSTA RICA: 1 female, Cartago Prov., 600 m, Turrialba, C.A.T.I.E., 19.V.1979, H. & A. Howden, feces cup trap; 5 males, 2 females, Puntarenas Prov., 1400 m, Monteverde, 25, 27.V.1979, H. & A. Howden, sitting on leaves near trail at night, and in cup traps.

Paratypes are in: Ottawa, Washington, Howden.

REMARKS. The one Panamanian paratype measures 5.0 mm in length but otherwise does not vary significantly from the allotype. Within the Panamanian fauna this species is most likely to be confused with *tenebrosum*; however, the complete lack of any tubercles on the head, the very broad dorsal portion of the eye, and the relatively small size is sufficient to distinguish the species within the geographic area being considered. Costa Rican specimens show some variation in the sculpture of the pronotum and elytral intervals, but otherwise do not vary significantly. A related species occurs in Belize.

13. Canthidium pallidoalatum n. sp.

Figs. 162-164

HOLOTYPE. Male, length 4.2 mm, greatest width 2.7 mm. Head, pronotum, elytral margins and sutural intervals dark brownish black to black, remainder of elytra ivory to light tan; strial lines irregularly spotted with gray; dorsal surfaces shining, pronotum and elytral intervals minutely punctate. Clypeus (Fig. 162) feebly bidentate, median emargination shallow, broadly V-shaped, margin laterally arcuate to middle of gena. Surface of clypeus moderately transversely rugose. Frons with two vague swellings, one on each side near inner anterior edge of eye, area between swellings feebly concave. Eye dorsally at posterior edge of gena strongly narrowed, three to four facets wide. Pronotum evenly convex, lateral fovea small, oval, shallow; posterior pronotal margin lacking adjacent transverse groove or row of punctures. Elytral striae represented by faint lines interrupted by large shallow punctures, the shallowly impressed punctures delimiting striae and separated by approximately two to three diameters, strial punctures frequently somewhat darker in color than surrounding portions of elytra; intervals nearly flat, closely, finely punctate. Pygidium finely punctate, surface between punctures faintly granular. Posterior surface of fore femur with two coarse, setose punctures near margin at apex; remainder of surface with vague minute punctures or finely shagreened. Ventral surfaces and middle and hind femora minutely punctate and slightly shagreened. Fore tibial spur not greatly modified, slender, somewhat shorter than in female, inner apical angle of tibia adjacent to spur, produced anteriorly and slightly bent downward forming a broad, abruptly rounded lobe approximately equal in length to tibial spur. Genitalia as in figs. 163, 164.

ALLOTYPE. Female, length 4.3 mm, greatest width 2.6 mm, different from holotype in the following major characters: clypeal margin laterally feebly arcuate, clypeal surface more strongly rugose; punctures in elytral striae occasionally separated by four to five diameters, frequently not conspicuously darker than surrounding surface. Fore tibial spur one-third longer than in male, inner apical angle of tibia not produced.

TYPE MATERIAL: Holotype, male, Panama, Chiriqui Prov., Las Lagunas, 5 km SW Hato del Volcan, 1360 m, 22-26.V.1977, S. Peck, dung trap (Howden). Allotype, female, same locality as holotype, 22.V.1977, S. & J. Peck, litter Berlese No. 371 (Howden).

PARATYPES: 8 males, 2 females. PANAMA: 2 males, same data as holotype; 6 males, 2 females, Chiriqui Prov., Las Lagunas, 4 km W Hato del Volcan, 1200-1360 m, 27.V.-1.VI.1977, H. & A. Howden, cup traps.

Paratypes are in: Ottawa, Washington, Howden.

REMARKS. Variation in the type series is slight, size ranging from 4.0 to 5.0 mm. Color of the elytra shows slight variation but this seems primarily due to method of preservation. Initially the elytral disc was primarily ivory in color, darkening after death. In other respects the type series is very uniform. The species can be readily confused with leucopterum which also has mostly ivory colored elytra and is at least partially sympatric. Canthidium leucopterum can be distinguished from the above species by the following combination of characters: slightly smaller average size, distinctly bidentate clypeus and a trituberculate frons. Other distinguishing characters are mentioned in the key.

The majority of specimens were taken in traps baited with human feces.

14. Canthidium variolosum n. sp.

Figs. 165-167

HOLOTYPE. Male, length 4.3 mm, greatest width 2.7 mm. Dorsally very dark brown to black, humeral area light reddish brown; pronotum at elytral intervals minutely punctate, some areas finely shagreened. Clypeus (Fig. 165) quadridentate, the inner two teeth strongly developed, median emargination V-shaped; outer teeth on each side feebly developed, obtusely rounded, approximately one-quarter the length of adjacent inner teeth. Lateral margin of clypeus slightly sinuate to small notch at junction with gena; clypeal surface shallowly closely punctate. Frons tridentate, the three conical protuberances feebly developed, widely separated, median one distinctly anterior in position; surface between with scattered fine punctures and granulate. Eye dorsally near the posterior end of gena narrow, two to three facets wide. Pronotum evenly convex, lateral fovea on each side small, circular, relatively deep; posterior pronotal margin lacking associated groove or punctures. Elytral striae represented by faintly impressed lines, rarely small punctures visible in strial line but striae largely appearing impunctate; intervals largely flat, minutely punctate, shining. Pygidium smooth to minutely punctate, shining. Posterior or ventral surfaces of all femora smooth to minutely punctate, finely shagreened. Fore tibia with apical spur not obviously modified, slightly shorter than in female; adjacent inner apical portion of tibia produced into acutely rounded lobe, slightly inflexed near tibia, the lobe approximately equal in length to tibial spur. Genitalia as in figs. 166, 167.

ALLOTYPE. Female, length 4.1 mm, greatest width 2.5 mm. Differing from male in the following major characters: clypeus transversely rugose; pronotal fovea less deeply impressed, pronotum slightly more obviously punctate; inner apex of fore tibia not produced into an acutely angled lobe.

TYPE MATERIAL: Holotype, male, Panama, Chiriqui Prov., Las Lagunas, 1360 m, 4 km W Hato del Volcan, 1.VI.1977, H. & A. Howden, cup trap baited with human feces (Howden). Allotype, female, same data as holotype (Howden).

PARATYPES: 7 males, 9 females. PANAMA: 3 males, 8 females, same locality as holotype, 22-27.V.1977, S. & J. Peck, H. & A. Howden; 3 males, 1 female, Chiriqui Prov., 2 km N Sta. Clara, 1300 m, 8°51'N, 82°46'W, Hartmann's Finca, 25, 30-31.V.1977, H. & A. Howden, human feces cup trap, S. & J. Peck, litter ber. #371, ber. #372 under bark; 1 male, Chiriqui Prov., 4900 ft., W of Finca, Palo Santo, nr. Nueva California, 6.III.1959, H.S. Dybas, Berlese ravine litter.

Paratypes are in: Chicago, Ottawa, Washington, Howden.

REMARKS. The restricted range, small size and quadridentate clypeus will usually distinguish the species. Size varies from 3.4 to 4.3 mm and elytral color varies from black to mostly ivory.

15. Canthidium leucopterum n. sp.

Figs. 168-170

HOLOTYPE. Male, length 3.7 mm, greatest width 2.0 mm. Head, pronotum, and pygidium dark brown to black; elytra ivory (darkening slightly when preserved), sutures and margins narrowly, evenly brown or black. Clypeus (Fig. 168) bidentate, median emargination narrowly U-shaped; margins on either side slightly irregularly arcuate to middle of gena; clypeal surface feebly reflexed in anterior half, reflexed portion finely, transversely rugose. Frontal area trituberculate, median tubercle anterior to and more distinctly conical than either lateral tubercle; surface near and between tubercles finely granular with small scattered punctures. Eye dorsally at posterior end of gena very narrow, two to four facets wide. Pronotum with lateral fovea appearing as large puncture, disc evenly convex, minutely punctate, shining; posterior margin lacking adjacent anterior row of punctures or indentation. Elytral striae indicated as faint lines, strial punctures obsolete; intervals nearly flat, surface slightly irregular. Pygidial surface shining with small to moderate, relatively inconspicuous punctures. Posterior surface of fore femur lacking coarse punctures, surface finely granular, with some scattered, minute punctures; middle and hind femora ventrally minutely punctate or finely shagreened or both. Fore tibia with spur apically acute, unmodified; inner apex of tibia moderately produced, apex acutely angled. Genitalia as in figs. 169, 170.

ALLOTYPE. Female, length 4.0 mm, greatest width 2.5 mm. Differing from holotype in the following major characters: clypeus nearly flat, more strongly rugose; head and pronotum slightly more densely and distinctly punctate; inner apical angle of fore tibia not produced anteriorly, not acutely angled.

TYPE MATERIAL: Holotype, male, Panama, Chiriqui Prov., (2 km W) Cerro Punta, 1500 m, 23.V.1977, H. Howden, cup traps (baited with 2-3 cc human feces) (Howden). Allotype, female, same data as holotype.

PARATYPES: 8 males, 7 females. PANAMA: 1 male, 2 females, same data as holotype; 1 male, 1 female, Chiriqui Prov., 2 km W Cerro Punta, 8°51'N, 82°36'W, 22.V.1977, H. Howden, cup traps; 1 female, same locality as holotype, 19.V.1977, S. & J. Peck, Berlese sample No. 366; 5 males, 2 females, Chiriqui Prov., 4 km W Hato del Volcan, 1200-1360 m, 27.V.-1.VI.1977, H. & A. Howden, cup traps; 1 male, Chiriqui Prov., Las Lagunas, 5 km SW Hato del Volcan, 22.V.1977, S. & J. Peck, litter berlese, No. 371. COSTA RICA: 1 female, Melleza, 1300 m, (near Candelas, Panama), 7.VI.1977, H. & A. Howden.

Paratypes are in: Ottawa, Washington, Howden.

REMARKS. Canthidium leucopterum may be confused with variolosum and pallidoalatum, which frequently also have the elytra mostly ivory in color. The elytral margins evenly and narrowly marked with brown or black and the trituberculate frons will distinguish leucopterum. These markings do not show significant variation; size ranges from 3.0 to 4.2 mm.

16. Canthidium ardens Bates

Figs. 171-173

Canthidium ardens Bates, 1887, p. 48.

Cotypes, London and Paris. London specimens examined.

Length 3.7 to 5.6 mm. Dorsally brownish black to black with distinct cupreous cast, head and pronotum frequently with greenish luster in certain lights. Pronotal disc and elytral intervals appearing smooth and polished at low magnification. Clypeus (Fig. 171) feebly bidentate, median emargination broadly V-shaped; clypeal margin laterally arcuate to gena, there slightly to moderately notched; surface of clypeus and gena moderately, closely punctate. Frons trituberculate, tubercles feebly developed, median one approximately twice as large as lateral ones and anterior in position. Surface of frons and vertex moderately to finely punctate. Eye dorsally at posterior end of gena narrow, two to four facets wide. Pronotum evenly convex except for small oval lateral fovea on each side, posterior margin lacking adjacent groove or punctures. Elytral striae either lacking or indicated by faint, often obsolete lines, intervals when distinguishable usually smooth and flat, shining. Pygidium minutely punctate, shining. Posterior surface of fore femur with one or two coarse setose punctures in apical third, remainder impunctate, finely shagreened; middle and hind femora with ventral surface mostly impunctate, finely shagreened. Fore tibial spur of male similar to that of female but more bluntly rounded. Inner apical margin of fore tibia of male produced into distinct rounded anterior projection approximately equal to half the length of adjacent spur. Male genitalia as in figs. 172, 173.

MATERIAL EXAMINED. PANAMA, 25 specimens from: CANAL ZONE - Barro Colorado Island; Trinidad River. CHIRIQUI PROV. - near Boquete on Rio Caldera, 6000 ft.; 2 km N Santa Clara, Hartmann's Finca; Santa Clara; Volcan de Chiriqui, 2500-4000 ft., Champion (cotypes). COCLE PROV. - El Valle, tributary of Rio Anton; El Valle, tributary of Rio Guaybo. COLLECTION DATES: January, February, May, June, July, August, November.

OTHER COUNTRIES, 31 specimens from: COSTA RICA.

REMARKS. The species varies considerably in size but can usually be recognized by its shining cupreous or greenish dorsum, feebly to distinctly trituberculate frons, non-punctate elytral striae, and by the obsoletely punctate anterior midline of the metasternum. While specimens that we are calling ardens vary considerably in size and color, a series from Turrialba, Costa Rica, at 600 m, average 5 mm in length while a series from Monteverde, Costa Rica, at 1400 m, average only 4 mm. In the two series there is no overlap in size, the larger form is more cupreous, the small one greener. Panamanian specimens have not shown these consistent differences. At present we have no evidence that two or more species are included under ardens, but there is the possibility that we are confusing two species under one name.

The species (one or two) has been collected from fermented palm fruits, rat carrion, horse manure, and human feces. Canthidium ardens is diurnally active and has been most frequently collected in the wet season.

The species is found in moist forests at both low and middle elevations.

17. Canthidium aurifex Bates

Figs. 174-178

Canthidium aurifex Bates, 1887, p. 48.

Cotypes, London and Paris. London specimens examined.

Length 3.3 to 5.5 mm. Dorsally black with distinct greenish or cupreous reflections; dorsal surfaces shining, pronotal disc at elytral intervals with numerous extremely minute punctures. Clypeus (Figs. 174, 175) very feebly bidentate, median emargination shallowly, broadly V-shaped. Clypeal margin laterally evenly arcuate to gena, there margin feebly offset, then evenly arcuate to posterior of gena. Clypeal surface transversely rugose or closely contiguously punctate; gena closely punctate; frons trituberculate, each tubercle low, conical, the median tubercle distinctly anterior in position; surface of vertex closely, moderately punctate, less so posteriorly. Eye dorsally at posterior end of gena narrow, three to five facets wide. Pronotum evenly convex except for small circular lateral fovea on each side; area adjacent to posterior margin not punctate, not depressed. Elytral striae consisting of distinct indented lines interrupted by fairly evenly spaced coarse punctures; intervals nearly flat, shining, minutely punctate. Pygidium distinctly punctate, particularly in basal half, there separated by a distance approximately equal to one diameter. Posterior surface of fore femur with scattered minute punctures, the surface between finely shagreened, middle and hind femora ventrally with scattered minute punctures, surface between smooth to finely shagreened. Fore tibial spur of male (Fig. 176) flattened and enlarged in apical half, the apex emarginate, broadly V-shaped; inner edge of tibia at base of spur slightly produced anteriorly, forming an acute angle. Male genitalia as in figs. 177, 178.

MATERIAL EXAMINED. PANAMA, 91 specimens from: CANAL ZONE - Balboa; Barro Colorado Island; Canoa Saddle; Gatun Lake; Fort Sherman; 5 mi. NW Gamboa; Paraiso; Pipeline Road; Rio Trinidad. COLON PROV. - Portobelo. PANAMA PROV. - Cerro Campana, 850 m. COLLECTION DATES: January, February, March, April, May, June, July, September, November, December.

OTHER COUNTRIES, 36 specimens from: COSTA RICA, ECUADOR.

REMARKS. Canthidium aurifex exhibits a great variation in size and to a lesser degree also varies considerably in color.

The size range given in the description occurred in specimens from Barro Colorado Island. However, in some localities the size seems to be fairly consistent. Specimens taken near Turrialba (900 m), Costa Rica, averaged about 4 mm in length while specimens from Monteverde (1500 m), Costa Rica, averaged about 5 mm. Specimens from Rio Palenque (200 m), Ecuador, varied between 4 and 5 mm in length. Color ranges from black to black with strong green or cupreous reflections, the color often uniform in one locality, with Panamanian specimens often distinguishable from those from Ecuador.

Panamanian specimens of aurifex have been collected from forest floor leaf litter; leaf surfaces; and at tapir, howler monkey, and human feces.

On Barro Colorado Island this species is active throughout the daylight hours and is most abundant during the wet season. Teneral individuals occur only in the early-mid wet season, with dry season specimens usually damaged or well worn. A number of specimens were collected along forest trails sitting on leaves 14 to 25 cm above the ground. The species is primarily found in lowland moist forests.

18. Canthidium hespenheidei n. sp.

Figs. 179-182

HOLOTYPE. Male, length 3.6 mm, greatest width 2.3 mm. Dorsally dark brown with strong cupreous reflections, shining; pronotum and elytral intervals with scattered minute punctures, those on elytra often vague. Clypeus (Fig. 179) bidentate, median emargination U-shaped; margin laterally broadly, feebly arcuate posteriorly to junction with gena; clypeal surface moderately punctate, the punctures often contiguous. Entire frons slightly elevated above plane of clypeus, nearly flat, no tubercles present. Eye dorsally at posterior end of gena narrow, two to three facets wide. Pronotum evenly, moderately convex, lateral foveae obsolete; pronotum lacking line of punctures adjacent to posterior margin (Fig. 180). Elytral striae represented by feebly impressed lines, the lines impunctate or with small, poorly defined, inconspicuous punctures; punctures if present frequently separated by 10 or more diameters. Elytral intervals nearly flat, with scattered, minute punctures; most of surface smooth and polished. Pygidium shining, polished, with scattered minute punctures. Posterior surface of fore femur with one or two setose punctures near apex, remainder of surface smooth and shining. Ventral surfaces of middle and hind femora smooth, shining. Fore tibial spur slender, apex acute, slightly shorter than in female; inner apical angle of tibia strongly produced, abruptly bent downward, with apex broadly acute, the projection equal in length to tibial spur; tibial apex lacking distinct tuft of setae. Anterior third of metasternum between middle coxae distinctly punctate, the size and/or number of punctures not noticeably reduced medially (this character separates the species from other small, cupreous species, all of which have the metasternum impunctate or feebly punctate in anterior median third). Genitalia as in figs. 181, 182.

ALLOTYPE. Female, length 3.5 mm, greatest width 2.2 mm. Differing from holotype in the following major characters: clypeal disc transversely rugose; pronotum and elytral intervals with minute punctures obsolete; inner apical angle of fore tibia not produced; tibial spur longer.

TYPE MATERIAL: Holotype, male, Panama, Panama Prov., Cerro Campana, 850 m, 8°40'N, 79°56'W, 23.I.1970, H.A. Hespenheide (Howden). Allotype, female, same locality as holotype, 800 m, 30.V.1970, H.P. Stockwell (Howden).

PARATYPES: 6 males, 24 females. PANAMA: 2 females, Canal Zone, Barro Colorado Island, VII.1969, 20.VII.1978, N.E. Woodley, J. Lawrence, B. & T. Hlavac; 2 females, Canal Zone, 5 mi. NW Gamboa, 9°09'N, 79°43'W, 28.XI.1969, H.A. Hespenheide; 1 female, Canal Zone, Madden Forest, mile 2.5, 9°05'N, 79°37'W, 24.I.1970, H.A. Hespenheide; 1 male, 2 females, Panama Prov., same locality as holotype, 12.V.1974, 13.V.1973, 30.V.1970, H.P. Stockwell; 1 male, Panama,[C.Z.], Camp Chagres, 26-27.X.1967, T. Taylor; 1 male, Panama Prov., Cerro Azul, ca. 2000 ft., 21.II.1976, A. Newton, in wet debris small forest stream. ECUADOR: 3 males, 15 females, Pichincha Prov., 47 km S Sto. Domingo, 700 ft., Rio Palenque, 22-27.II.1976, H. & A. Howden, V. Nealis; 1 female, Pichincha Prov., 3 km E Tandapi, 4300 ft., 21.VI.1975, S. & J. Peck, wet ravine; 1 female, Pichincha Prov., Tinalandia, 650 m, 15-28.VI.1975, S. & J. Peck.

Paratypes are in: Cambridge, Chicago, Ottawa, Washington, Howden.

REMARKS. *Canthidium hespenheidei* is seemingly the smallest species in the genus occurring in Panama, with the size ranging from 2.6 to 4.1 mm. It can occasionally be confused with small specimens of *C. ardens* that lack distinct tubercles on the frons. In these cases, the distinctly punctate anterior median third of the metasternum and the shape of the male genitalia will distinguish *hespenheidei* from *ardens*. The small size of *hespenheidei*, in conjunction with the nearly flat frons, the strial lines on the elytra lacking punctures and the modification of the male fore tibia will separate the species from other *Canthidium*. Panamanian specimens have strong coppery reflections while specimens from Ecuador have strong green reflections and average slightly larger in size.

The species is named in honor of Dr. Henry Hespenheide in recognition of the many interesting species of Panamanian Scarabaeinae that he has collected and made available to us.

This species has most frequently been taken sitting on leaves 10 to 15 cm above the ground. A few specimens were collected at human feces.

Onthophagus Latreille

Onthophagus Latreille, 1802, p. 141; Bates, 1887, p. 66.

Type-species: *Scarabaeus taurus* Schreber, by monotypy.

The genus *Onthophagus*, with over 1500 species described, is one of the largest genera of organisms. Even in Panama, where only 19 species are known to occur, there is a considerable diversity in the morphology. The genus, because of its large size and diversity, is difficult to define morphologically without a relatively lengthy description.

In Panama, species in the genus *Onthophagus* are small to moderate in size, 3 to 13 mm in length, oblong oval, with a short thick compact body, convex above and below, with middle legs far apart and hind legs far back. Males usually have the head horned or tuberculate and (or) the pronotum with horns or other protuberances; females have the head carinate and sometimes the pronotum with a carina or other elevation. The mentum is hairy, transverse, quadrangular, emarginate; labial palpi hairy, 3 segmented, first segment slightly shorter than second, third very small and inconspicuous. Labrum membranous, densely ciliate, concealed by clypeus. Mandible elongate, rounded, without teeth, membranous toward apex, and ciliated on internal edge. Maxillae terminate in large membranous ciliated lobes; palpi 4 segmented, first segment short and slender, second and third short and thickened, fourth fusiform and truncate at the end. Clypeus relatively smooth in male, carinate in female, variable in shape. Antenna 9 segmented, with 3-segmented club. Scutellum not visible. Elytron short, somewhat narrowed and rounded posteriorly; with seven striae. Fore tibia quadridentate, often slender and elongate in male; fore tarsi present in both sexes; middle and hind tibiae apically enlarged and truncate; tarsi slender, ciliated on inner edge; first segment elongate and subparallel; claws small. Metasternum long and parallel sided, separated from mesosternum by rectilinear groove. Pygidium exposed. Males with last abdominal segment broadly emarginate at middle; females with last segment not constricted at middle.

Key to species of *Onthophagus*

1. Pronotal surface with at least some scattered, erect setae, the setae obvious in fresh specimens at 10X, longer than one puncture diameter; if setae short, then elytra bicolored . . . 2
Pronotal surface lacking setae longer than diameter of puncture; elytra usually but not always uniform in color. 7

2. Dorsally brown to black or bicolored; pronotal surface dull if uniformly black, otherwise frequently shining; average size under 8 mm . . 3
Dorsally uniformly black, often with green or blue reflections; pronotal surface between setose punctures smooth and shining; average size 8 to 9 mm . . . . 3. *crinitus panamensis* Bates

3. Pronotal punctures appearing annulate; rim abrupt, depressed portion of punctures shallow, flat; color dorsally uniform 4

Pronotal punctures simply impressed, rim rounded; dorsally mottled or bicolored 5

4. Pronotal punctures not contiguous, most separated by distance equal to one-half diameter or more; size moderate, 5 to 8 mm . . 14. *atrosericeus* Bouc.

Pronotal punctures mostly contiguous; size small, 3.5 to 5.0 mm . . . . 11. *coscineus* Bates

5. Pronotum anteriorly with broad protuberance, either with small lateral tubercle on each side or prominence feeble and rounded; clypeus anteriorly rounded, sometimes briefly truncate but not shallowly emarginate; pronotum frequently with sides broadly marked with brown, longitudinal central third or more dark brown to black, sometimes with cupreous reflections . . 6

Pronotum anteriorly with small V-shaped median prominence often overhanging anterior margin, or prominence very small, rounded or lacking; clypeus anteriorly shallowly emarginate or truncate; pronotum usually mostly or entirely black, frequently with greenish cast . . . . 13. *landolti* Har. (complex)

6. Pronotum in both sexes with well defined truncate or broadly convex protuberance; elytra usually with intervals alternately tan and dark brown or black; average size 5.5 mm . . . . 8. *marginicollis* Har. (in part)

Pronotum at most tumid behind head, elytra uniformly brown or irregularly mottled, not striped; average size 5 mm . . . . . 9. *lebasi* Bouc.

7. Pronotum and elytra distinctly different in color or elytra mottled or bicolored 8

Pronotum and elytra similar in color (sometimes pronotum with more pronounced greenish cast but basic color uniformly dark brown or black) . 10

8. Elytra uniform in color or mottled, never with intervals alternately differing in color 9

Elytra with intervals alternately tan and dark brown or black . . . . 8. *marginicollis* Har. (in part)

9. Pygidial surface basally between punctures dull, finely granular or shagreened; hind femur ventrally with a short row of 3 or 4 coarse punctures, otherwise surface smooth or with a few minute punctures; male with erect horn near inner posterior edge of each eye . . . . 7. *transisthmius* n. sp.

Pygidial surface basally between punctures shining, smooth; hind femur ventrally with widely scattered moderate-sized punctures; male with abruptly reflexed, nearly truncate, anterior clypeal margin, lacking horns on head . . . . 10. *chryses* Bates

10. Pronotum punctate or not, evenly convex or with broad tumosities or with paired horns, plates or tubercles, never with a single anterior median conical horn or elongate tubercle 11

Pronotum heavily punctate with single anterior median horn or tubercle, in males horn projecting anteriorly over head, bifurcate apically; in females forming an acute vertical tubercle at anterior margin; average size 8 mm . . . . 16. *mirabilis* Bates

11. Color dark brown to black, frequently with greenish-blue metallic reflections; middle and hind femora not differing greatly in color from ventral surfaces, brown to black . . . 12

Color brown to dark brown (pronotum and elytra heavily punctate); middle and hind femora (and often fore femur) mostly yellowish; average size 5.5 mm . . . . . . 12. *dicranius* Bates

12. Pronotum smooth or punctate, if punctate, the punctures generally of uniform size in any one area 13

Pronotum distinctly punctate, punctures centrally of two sizes; medium punctures separated by one to two diameters with small to minute punctures interspersed (dorsal surface of pronotum and elytra dull; color uniformly black with bluish cast); average size 9 mm . . . . 15. *cyanellus* Bates

13. Pronotum bituberculate or with paired swellings either side of midline; some species with acute tubercles deeply separated at midline 14

Pronotum evenly convex or with median protuberance evenly rounded, anteriorly not impressed or divided at anterior midline 17

14. Setae at apex of hind tibia mostly stout, with some fine setae between, mostly of similar length; pronotal protuberances narrowly divided 15

Setae at apex of hind tibia alternating between stout and slender, the slender setae often considerably longer; pronotal protuberances separated medially by a distance equal to about half width of vertex; average size 8 mm . . 16

15. Elytral intervals finely punctate, surface feebly shining; dorsal color black usually with strong green or cupreous cast; average size 6 to 7 mm . . . . 18. praecellens Bates
Elytral intervals obsoletely punctured or impunctate, surface dull, minutely granular; dorsal color dark brown to black, occasionally with bluish reflections; average size 7 to 8 mm . . . . .19. belorhinus Bates

16. Pygidial surface distinctly shagreened or granular, at most feebly shining; if horns on vertex, clypeal-frontal carina absent or highest medially; if horns lacking then carina on vertex nearly straight and slightly lower medially 19
Pygidial surface between punctures at most feebly shagreened, strongly shining; if horns on vertex, clypeal-frontal carina higher on either side of midline; if no horns on vertex, then carina on vertex ogival (brace-like) in shape . . . . .4. stockwelli n. sp.

17. Pronotal surface shining, at least medially; color dorsally frequently with metallic coppery, bluish or greenish cast 18
Pronotal surface dull, opaque, particularly in median posterior half; color dorsally black, occasionally with greenish cast on pronotum; average size 6 to 7 mm . . . . . 5. nyctopus Bates

18. Hind femur relatively stout, width to length about 3:7; clypeal margin medially rounded or with wide reflexed area or with broad, rounded accumination 19
Hind femur relatively slender, width to length about 3:9; clypeal margin medially with distinct, strongly reflexed horn (often expanded apically) or with margin with sharp V-shaped emargination; average size 7 to 8 mm . . . . 17. sharpi Har.

19. Metasternum between middle coxae finely, shallowly punctate near coxal margins 20
Metasternum between middle coxae coarsely, distinctly punctate near coxal margins, punctures separated by approximately one to two diameters; average size 8 to 10 mm . . . . 2. batesi H. & C.

20. Color dorsally black with blue or blue-green reflections; metasternum anteriorly distinctly prow-shaped; well-developed males with anterior clypeal margin broadly truncate or shallowly emarginate; size frequently over 8 mm . . . . 1. incensus Say

Color dorsally very dark brown to black with feeble metallic luster, particularly on pronotum; metasternum anteriorly only feebly tumid medially; well-developed males with anterior clypeal margin obtusely angulate medially; size usually under 8 mm . . . . 6. acuminatus Har.

1. Onthophagus incensus Say

Fig. 183

Onthophagus incensus Say, 1835, p. 173; Howden and Cartwright, 1963, p. 24.

Type, Cambridge. Examined.

Length 7.0 to 11.0 mm. Dorsally black with bluish or greenish reflections, particularly on head and pronotum; head and pronotal disc of large males impunctate, smooth and shining; in small males and females head and pronotum moderately, closely punctate; elytral intervals feebly punctate, surface dull; pygidium shallowly, closely punctate, dull. Metasternum between middle coxae with midline briefly but distinctly carinate; on either side of carinate area metasternum with scattered, shallow, poorly defined setose punctures. Middle femur ventrally with coarse punctures in apical half; hind femur ventrally with surface largely smooth or finely punctate (usually more distinctly punctate in females).

MALE. Major form (Fig. 183): clypeus in apical third broadly, truncately reflexed, the reflexed portion often feebly, broadly emarginate; clypeal surface smooth. Lateral margin of clypeus and gena slightly sinuate, gena posteriorly inwardly arcuate. Clypeal-frontal carina absent; carina of vertex represented by long, cylindrical, inwardly arcuate horn arising from inner posterior edge of eye. Pronotum with anterior protuberance rising just behind anterior margin, the protuberance delimited on either side by a concave groove for the reception of the horn, each groove feebly, longitudinally arcuate, not strongly convergent posteriorly. Lateral anterior surfaces of pronotum shallowly, closely punctate, median posterior areas frequently impunctate, shining. Fore tibia only slightly elongate, lacking apical tuft of setae, similar in form to female. Minor form: clypeus arcuate or only feebly truncate, scarcely reflexed, surface closely punctate. Clypeal-frontal carina indicated by transverse swelling, carina of vertex a low transverse ridge, median portion slightly posterior in position; horns absent. Pronotal protuberance and related grooves obsolete to absent.

FEMALE. Clypeus shallowly arcuate, evenly reflexed, surface transversely rugose . Clypeal-frontal carina complete, transverse, highest medially. Carina of vertex nearly straight, slightly elevated on each side at termination near eye. Pronotum with protuberance low, delimited on each side by a small rounded tubercle, pronotal surface moderately punctate, closely so laterally, less densely so medially.

MATERIAL EXAMINED. PANAMA, 103 specimens from: CHIRIQUI PROV. - Baldwin Forest; Bambito; Cerro Punta; El Valle de Nubes, 4500 ft.; Finca Lerida; Hartmann's Finca; Las Lagunas, 1360 m; Rovira (12 miles NW); Santa Clara; Volcan de Chiriqui. PANAMA PROV. - Cerro Campana. VERAGUAS PROV. - Potrerillos. COLLECTION DATES: January, March, May, June, October, December.

OTHER COUNTRIES, 104 specimens from: MEXICO, EL SALVADOR, COSTA RICA, VENEZUELA, COLOMBIA, ECUADOR.

REMARKS. The species has been obtained from horse, human, and tapir feces. In Panama it is restricted to moist forest areas at middle elevations.

2. Onthophagus batesi Howden and Cartwright

Fig. 184

Onthophagus batesi Howden and Cartwright, 1963, p. 21.

Type, Washington. Examined.

Length 6.0 to 9.5 mm. Dorsally dark brown to black, occasionally with slight greenish luster; impunctate to finely punctate, punctures of elytral intervals frequently with minute, very inconspicuous setae. Pronotum varying from smooth and polished (large males) to finely, distinctly, punctate (small males and females), surface between punctures smooth and shining. Elytra with striae feebly impressed, each stria represented by a double line interrupted by shallow punctures, usually separated by approximately two diameters. Intervals flat with irregularly scattered minute punctures, surface between shagreened or finely granulate, feebly shining. Pygidium closely punctate, punctures frequently irregular, sometimes becoming confluent, forming area of transverse rugosity, surface shagreened, setae lacking or minute. Metasternum between coxae with numerous large, distinct, setose punctures present in two-thirds of area between coxae; median area raised, midline shallowly impressed; median area, particularly posteriorly, lacking large punctures, with only scattered minute punctures, surface mostly smooth and shining. Hind femur with a few scattered coarse punctures concentrated in apical anterior half of ventral surface, remainder of surface with a few minute punctures, the surface smooth and shining.

MALE. Major form (Fig. 184): clypeus with anterior margin abruptly reflexed, the area almost truncate or very shallowly, broadly emarginate; posterior portion of clypeus and frons lacking a carina or with carina vaguely indicated laterally, surface nearly flat, finely, distinctly, punctate. Lateral margin of clypeus in conjunction with gena slightly sinuate, feebly indented at junction between clypeus and gena. Vertex with two long, widely separated, slightly divergent vertical horns; the horns nearly straight, feebly transversely flattened, with a very distinct U-shaped carina extending from the middle of the horn downward and across to other horn. Pronotum posterior to horns broadly, shallowly, concave. Pronotal protuberance between horns broadly rounded anteriorly, not sharply delimited laterally, remainder of pronotum evenly convex. Fore femur slightly elongated, lacking distinct tuft of setae but with slightly upturned tooth above apical spur. Minor form: clypeus only moderately reflexed anteriorly, the reflexed portion frequently truncate, surface of clypeus more heavily punctate, occasionally transversely rugose, clypeal-frontal carina often evident as low transverse ridge, horns on vertex greatly reduced, but with U-shaped carina still evident. Pronotal protuberance occasionally reduced to feeble tumosity. Fore tibia may be unmodified, similar to that of female.

FEMALE. Clypeus with anterior margin truncate or feebly emarginate, weakly reflexed, clypeal-frontal carina low, of nearly uniform height; clypeal surface transversely rugose. Carina on vertex transverse, very slightly arcuate with lateral termination slightly posterior, not clearly defined. Pronotum with weak median protuberance, often with very slight lateral concavity on each side.

MATERIAL EXAMINED. PANAMA, 3 specimens from: CANAL ZONE - Ancon; Camp Chagres; Coco Solo Hospital. COLLECTION DATES: July, August, October.

OTHER COUNTRIES, 108 specimens from: MEXICO, BELIZE, EL SALVADOR, NICARAGUA, COSTA RICA.

REMARKS. One Panama specimen was captured in a light trap. One Costa Rican specimen was obtained from the stomach of a bat, Nyctidromus albicollis. Other specimens from Nicaragua were found under cow dung. The species is frequently common in cut-over areas.

3. Onthophagus crinitus panamensis Bates

Fig. 185

Onthophagus crinitus var. panamensis Bates, 1887, p. 68.

Cotypes, London and Paris. London specimens examined.

Length 7.0 to 10.0 mm. Dorsally black, frequently with greenish or metallic reflections, particularly on head and pronotum; dorsum punctate-setose, setae erect, pale yellowish or tan; pronotal punctures separated by less than one diameter, surface between smooth and shining. Elytral intervals distinctly, irregularly punctate, the punctures slightly smaller than on pronotum, separated by about one diameter, each stria represented by feebly impressed double line frequently interrupted by punctures. Pygidium with punctures similar to those of pronotum, surface between smooth and shining, most punctures with long erect setae. Metasternum and ventral surfaces of all femora with scattered coarse setose punctures, most punctures separated by two to three diameters.

MALE. Major form (Fig. 185): clypeus with sides converging to broadly truncate reflexed apex, apex often very shallowly emarginate, lateral margin of clypeus and gena forming nearly straight line. Dorsum of head moderately to coarsely punctate. Frontal carina absent, carina of vertex represented on each side by long, upright, inwardly arcuate horn arising from posterior portion of vertex behind eye. Pronotum with median protuberance rising vertically above anterior margin, the protrusion limited on each side by broad, shallow groove; groove on each side directly beyond horn on head and extending inwardly behind anterior margin of protrusion, remainder of pronotum evenly convex. Fore tibia distinctly elongated with a tuft of yellowish setae at base of apical spur. Minor form: clypeus similar to female except slightly more broadly truncate anteriorly. Clypeal-frontal carina present, feebly developed. Carina on vertex present medially, lateral horns feebly indicated or totally lacking in very small specimens. Pronotum with minute swelling on either side of midline indicating vestige of pronotal protuberance, otherwise pronotum evenly convex. Fore tibia unmodified.

FEMALE. Clypeus arcuate, often more broadly so anteriorly. Surface closely punctate to transversely rugose, both clypeal-frontal carina and carina of vertex present, indicated by low, nearly straight or feebly arcuate ridges, highest medially. Pronotum with small tuberculate swelling on either side of midline posterior to anterior margin, pronotum otherwise evenly convex.

MATERIAL EXAMINED. PANAMA, 126 specimens from: CANAL ZONE - Ancon; Barro Colorado Island; Cabima; Canoa Saddles; Fort Kobbe; France Field; Madden Forest; Paraiso; Pipeline Road. COLON PROV. - Alhajuela. PANAMA PROV. - Arraijan. COLLECTION DATES: Every month of the year.

OTHER COUNTRIES, None.

REMARKS. The use of a subspecies name for Panama specimens is seemingly valid. The nominate species from Mexico has smaller punctures on the pronotum, the head is usually less punctate and in large males the horns of the vertex are more arcuate with apices flattened. While the differences are quite small, they seem to be consistent and hence the Panamanian specimens are treated as distinct.

Onthophagus c. panamensis has been obtained at rat carrion and on horse, howler monkey, human, and tapir feces. On Barro Colorado Island, *panamensis* is active from 0700 to 1900 hours with no significant peaks of abundance during that period. It is most abundant during the dry season and early wet season and has only once been recorded from carrion. In Panama the species is seemingly restricted to lowland moist forests.

4. *Onthophagus stockwelli* n. sp.

Figs. 186–189

HOLOTYPE. Male (major), length 9.0 mm, greatest width 4.5 mm. Color dorsally black with faint brownish-purple tinge. Antennal club tan to reddish tan. Dorsal surface shining, setae mostly absent, a few very minute setae present on elytral intervals. Clypeus (Fig. 186) with margin laterally arcuate and feebly reflexed, anteriorly more strongly reflexed, slightly thickened, faintly emarginate, almost truncate; clypeal surface closely punctate; clypeal-frontal carina present, low, most distinctly elevated on either side midway between midline and inner margin of gena, carina in profile bisinuate (almost biangulate). Gena not expanded beyond line of clypeal margin, junction with clypeus slightly indented; gena and frons closely punctate. Vertex with low transverse carina terminating on either side near inner edge of eye in vertical, nearly straight, cylindrical horn; the two horns very slightly diverging; height of horns approximately 1 mm; vertex behind smooth. Pronotum (Fig. 186) with anterior median pronotal protrusion feebly developed, the pronotum behind head rising nearly vertically to a small rounded tubercle on either side of midline, protrusion thus bituberculate; remainder of pronotum evenly convex; surface just posterior to tubercles and near lateral margins finely, closely punctate, central posterior half of pronotum impunctate. Elytral striae impressed, each stria represented by an impressed single line interrupted by punctures separated by a distance equal to 3 to 5 diameters of one puncture; elytral intervals feebly convex, with scattered, distinct small punctures, some with minute setae; surface between punctures very smooth, shining. Punctate area of pygidium enclosed by marginal bead, three-fifths as long as wide, punctures separated by approximately one diameter, surface between very finely shagreened, shining. Fore tibia (Fig. 187) unmodified, similar to female, lacking apical tuft of setae and not elongated. Metasternum between middle coxae obsoletely carinate anteriorly, near coxae with a few scattered large punctures, otherwise metasternum centrally at most minutely punctate, largely smooth and shining. Middle and hind femora ventrally each with a row of four to six coarse punctures along median axis in apical third, numerous coarse punctures present near anterior margin, remainder of ventral surface minutely punctate, mostly smooth.

ALLOTYPE. Female, length 8.2 mm, greatest width 4.3 mm. Differing from male in the following characters: clypeal margin (Fig. 188) very briefly truncate anteriorly, otherwise arcuate; margin gradually becoming more strongly reflexed anteriorly, much less so than in male; clypeal-frontal carina low, transversely arcuate, highest medially; carina of vertex (Fig. 189) broadly ogival in shape, horns absent; pronotum nearly as in male but with tubercles of protrusion more pronounced.

TYPE MATERIAL: Holotype, male, Panama, Colon Prov., 270 m, 10 mi. SE Colon, Santa Rita Ridge, 10-12.VI.1977, S. Peck, carrion trap, day 2 (Howden). Allotype, female, Canal Zone, Barro Colorado Island, 25.V.1975, O.P. Young, tapir feces trap (Howden).

PARATYPES: 107 males, 128 females. PANAMA: 26 males, 27 females, same locality as allotype, taken on various days in January, February, May, June, September, October, November, December, by L.J. Bottimer, P.J. Darlington, T.L. Poulson, and O. Young, some taken at Ateles feces, coati feces, howler monkey feces, human feces, and tapir feces; 1 female, Canal Zone, Barro Colorado Island, 30.VI.1976, E.G. Riley; 1 female, Panama Prov., Cerro Azul, 24.V.1975, O. Young, tapir feces trap. ECUADOR: 71 males, 92 females, Pichincha, 47 km S Sto. Domingo, Rio Palenque Sta., 24-25.II.1976, Howden, Nealis, Peck, 19-25.V.1975, S. Peck, 28-31.VII.1976, S. Peck, all human dung traps, 17-25.II.1979, L. Ling, S. Marshall; 7 males, 5 females, Esmeralda, 11 km SE San Lorenzo, 5 m, La Chiquita Sta., 6-11.VI.1975, S. Peck, dung trap in forest; 3 males, 2 females, Manabi, 73 km NE Chone, 300 m, 90 km W Sto. Domingo, 6-9.VI.1976, S. Peck, dung traps.

Paratypes are in: Cambridge, Chicago, Ottawa, Washington, Howden, Poulson, Ratcliffe, Riley, Stockwell.

REMARKS. Variation is average for the genus. Length ranges from 5.7 to 8.7 mm. Dorsal color varies from dark brown to black with most specimens having slight blue or purple reflections; a few however, have a distinctly green cast. In minor males the pronotal protrusion may be greatly reduced, the tubercle on each side poorly defined; likewise the horn on either side of the vertex may be reduced to a small conical tubercle and in very small males the carinae of the head may be similar to females. In small females the two tubercles on the pronotum may be greatly reduced. There is some variation in the density and size of the pronotal punctures, but the species does not show the degree of variation found in some of the more variable species of Onthophagus.

The closest relative of stockwelli is an undescribed species from Oaxaca, Mexico, that has similar carinae and pronotal characters, but differs in several small characters and is readily separable by its grayish-black antennal club. Among species sympatric with stockwelli, small females of acuminatus are the most likely to be confused with it, but the ogival shape of the carina on the vertex of stockwelli is very distinctive. The bituberculate pronotal protrusion of stockwelli is also usually sufficient to separate it from sympatric species. The species is seemingly a wet-lowland forest form and is attracted to a variety of different kinds of animal feces. On Barro Colorado Island, stockwelli is mainly active from 700 to 1100 hours and 1400 to 1700 hours.

We are pleased to name this distinctive Onthophagus in honor of Dr. Henry Stockwell who assisted both of us on numerous occasions and who has collected many of the Scarabaeinae species occurring in Panama.

5. Onthophagus nyctopus Bates

Fig. 190

Onthophagus nyctopus Bates, 1887, p. 68.

Cotypes, London and Paris. London specimens examined.

Length 5.0 to 7.2 mm. Dorsally black, disc of pronotum opaque, imparting grayish sheen; anterior face of pronotal protuberance of some males greenish; dorsal setae absent. Head, pronotum and elytral intervals with small, shallow, sometimes shining punctures; punctures on pronotum separated by one to three diameters; punctures on elytral intervals frequently obsolete, particularly near suture. Elytral striae scarcely impressed, represented by distinct double line, the lines feebly interrupted by faint punctures separated by three to four diameters; intervals flat, surface distinctly shagreened or finely granular, dull. Pygidium closely punctate, punctures nearly contiguous, surface between shining; setae very inconspicuous or absent. Metasternum between middle coxae with scattered setose punctures near anterior lateral edge, median portion smooth to very minutely punctate; elevation of anterior midline rounded, not carinate. Middle and hind femora with scattered, coarse, setose punctures on outer half or third of ventral surface, remainder of surface smooth or minutely punctate.

MALE. Major form (Fig. 190): combined clypeal and genal margin evenly arcuate, narrowly reflexed, more strongly so anteriorly; clypeal surface finely punctate, punctures separated by approximately one diameter, surface between smooth and shining. Clypeal-frontal carina very low but distinctly indicated. Frons, anterior portion of vertex and gena less closely punctate than clypeus. Carina of vertex represented by two nearly straight, cylindrical, somewhat posteriorly inclined horns on either side near inner posterior margin of eye; each horn connected with its opposite by feeble ridge, inner edge of horns and connecting ridge being broadly U-shaped. Pronotum posterior to horns longitudinally concave, the pronotal protuberance between narrowly rounded anteriorly; remainder of pronotum evenly convex. Fore tibia unmodified, not elongated, lacking apical tuft of setae. Minor form: head not differing greatly from major form except horns reduced to small conical tubercles. Pronotal protuberance similarly reduced, particularly height of anterior face; concavity behind reduced horns frequently very small.

FEMALE. Differing from male in the following major characters: clypeal margin less reflexed, carina of vertex low, arcuately rounded on either side of depressed midline, the carina slightly angulate on either side near lateral termination. Pronotum with slight, rounded, anterior median protuberance; remainder of pronotum evenly convex, or with posterior midline faintly impressed, the posterior median third of pronotal disc appearing flattened.

MATERIAL EXAMINED. PANAMA, 13 specimens from: CHIRIQUI PROV. - Hartmann's Finca, 1200 m, 1300 m. PANAMA PROV. - Cerro Campana. COLLECTION DATES: May, August.

OTHER COUNTRIES, 70 specimens from: MEXICO, COSTA RICA.

REMARKS. Females of the species may be confused with females of acuminatus, but in acuminatus the pronotal surface is shining between punctures whereas in nyctopus much of the pronotal surface is dull, opaque.

This species has been collected only at human feces.

6. Onthophagus acuminatus Harold

Fig. 191

Onthophagus acuminatus Harold, 1880, p. 30.

Cotypes, Paris. Not seen.

Length 4.3 to 7.0 mm. Head and pronotum red-brown to very dark brown or nearly black; elytra darker than pronotum, dark brown to black; occasionally head and pronotum with metallic sheen. Dorsal setae lacking, pronotum with punctation variable, frequently mostly impunctate in male major, minutely punctate in either sex; if moderately punctate then usually female or male minor. Elytra with striae shallowly but distinctly impressed and with shallow strial punctures separated by approximately two diameters; intervals feebly convex with scattered small to moderate sized punctures, surface between smooth and shining. Pygidium with close, moderate to large punctures, most with a small, inconspicuous seta centrally; surface between punctures shining, less so basally where surface finely shagreened. Metasternum between coxae and ventral surfaces of middle and hind femora with scattered small to minute punctures, surface between shining.

MALE. Major form (Fig. 191): clypeus broadly acuminate anteriorly, apex reflexed with sides forming an obtuse angle, lateral portions of margin only slightly reflexed, feebly arcuate, feebly notched at junction with non-expanded gena. Clypeal-frontal carina absent medially, poorly developed laterally adjacent to and anterior to gena. Carina of vertex obsolete medially, represented on either side near inner, posterior edge of eye by nearly cylindrical, erect, slightly posteriorly inclined horn. Surface of head almost uniformly, moderately punctate, most punctures separated by less than one diameter. Pronotum longitudinally concave posterior to each horn; concavity on each side delimiting anteriorly rounded pronotal protuberance, rarely protrusion anteriorly flattened or slightly depressed along midline at summit; disc of pronotum impunctate or minutely punctate, surface very smooth and shining. Fore tibia similar to female, not unusually elongated, lacking tuft of apical setae. Minor form: clypeus with median apical margin scarcely reflexed, abruptly rounded, sometimes only obsoletely acuminate; clypeal-frontal carina low, complete, of nearly uniform height; carina of vertex sometimes present medially, particularly when horns reduced to small conical tubercles; pronotal protuberance reduced to slight anterior median swelling.

FEMALE. Differing from male as follows: clypeus arcuate, surface transversely rugose; clypeal-frontal carina complete, low, arcuate either side of feeble median depression; pronotum with slight, rounded, anterior median swelling or with pronotum evenly convex, surface usually more distinctly punctate than in male.

MATERIAL EXAMINED. PANAMA, 314 specimens from: CANAL ZONE - Ancon; Barro Colorado Island; Cabima; Coco Solo; Corozal; France Field; Gamboa; Madden Forest; Pipeline Road; Rio Frijoles; Rio Trinidad; Skunk Hollow. CHIRIQUI PROV. - Bugaba, 800-1500 ft.; David; Rovira. COCLE PROV. - El Valle, 2600 ft. PANAMA PROV. - Cerro Campana. COLLECTION DATES: Every month of the year.

OTHER COUNTRIES, 116 specimens from: COSTA RICA, COLOMBIA, ECUADOR.

REMARKS. This species has been recorded at light; in Virola sp. seed husks; on opossum, peccary, and rat carrion; and at coati, howler monkey, human, margay, spider monkey, and tapir feces.

On Barro Colorado Island, acuminatus is active throughout the period of 0600 to 2100 hours, particularly from 0600 to 0800 hours and 1600 to 1900 hours. It is one of the most abundant Scarabaeinae and is equally common in all months of the year. The preferred food appears to be feces, with a few individuals being found on carrion in the late wet season. The species is restricted to lowland moist forests, at least in Central Panama.

7. Onthophagus transisthmius n. sp.

Figs. 192, 193

HOLOTYPE. Male, length 5.5 mm, greatest width 3.2 mm. Head and pronotum (Fig. 192) very dark brown with cupreous cast, elytra and pygidium reddish brown. Clypeal margin broadly arcuate, anterior two-thirds narrowly reflexed; clypeal surface finely punctate adjacent to margin, remainder of clypeus and adjacent frons nearly impunctate and flat, clypeal-frontal carina absent. Gena in same plane as clypeus, margin very slightly flared to rounded median angulation. Vertex slightly uneven, carina obsolete across vertex between horns, horn on each side at inner edge of eye cylindrical, inclined posteriorly, feebly bowed. Pronotum posterior to horns shallowly, broadly concave; anterior median area between horns feebly elevated, face only slightly more convex than lateral areas of pronotum; concavities smooth, remainder of pronotal surface with numerous, evenly spaced small punctures, mostly separated by two to three diameters, obvious setae lacking, surface between punctures smooth to finely shagreened, shining. Elytral striae each represented by slightly impressed double line, the line interrupted by shallow punctures separated by two to four diameters; intervals flat, minutely punctate, surface largely granular; punctures of marginal intervals with small, inconspicuous, pale setae. Pygidium with large, shallow, somewhat irregular punctures, some lateral ones with setae; surface between punctures shagreened, becoming granular basally, feebly shining to dull. Fore tibia similar to female, not elongated, lacking apical tuft of setae. Metasternum between middle coxae with scattered, coarse, setose punctures near coxae, minutely punctate and shagreened medially, midline anteriorly elevated, broadly rounded, not carinate. Middle and hind femora each with scattered coarse punctures on outer half of ventral surface.

ALLOTYPE. Female, length 5.9 mm, greatest width 3.1 mm. Differing from holotype in the following major characters: clypeal and genal margins (Fig. 193) evenly arcuate, clypeal margin only slightly more arcuate anteriorly than laterally, surface transversely rugose. Clypeal-frontal carina low, arcuately elevated to midline; frons, genae, and vertex moderately punctate; carina of vertex low, slightly depressed medially, outer third on each side slanted posteriorly toward posterior margin of vertex near inner edge of eye; pronotum with feebly raised, rounded, anterior median protrusion; posterior third of pronotal midline feebly, broadly concave, opaque; pronotal surface with punctures slightly deeper, more pronounced than in male, most with very minute, extremely short central seta, length of seta equal to approximately half diameter of puncture.

TYPE MATERIAL: Holotype, male, Panama, Canal Zone, Gamboa, Limbo Hunt Club, 23-24.X.1975, O.P. Young, tapir feces trap (Washington). Allotype, female, same data as holotype (Washington).

PARATYPES: 11 males, 7 females. PANAMA: 8 males, 5 females, same data as holotype; 1 male, 1 female, same data as holotype except taken in human feces trap; 1 female, same locality as holotype, 18.V.1975, O.P. Young, tapir feces trap; 1 male, Canal Zone, Frijoles, 2-3.XI.1975, Buena Vista P., O.P. Young, tapir feces trap; 1 male, Canal Zone, Skunk Hollow, 14.VII.1975, B.C. Ratcliffe.

Paratypes are in: Ottawa, Washington, Howden, Ratcliffe.

REMARKS. Variation in the series is not great. Size ranges from 4.3 to 5.5 mm. In females pronotal color usually has a more greenish tinge and in both sexes the elytra vary from tan to dark brown (in greasy specimens the metathoracic wings are partly visible and tend to darken the elytra). In minor males the clypeal margin is feebly reflexed, horns reduced to conical tubercles and the pronotal protrusion is only feebly developed. Pronotal punctures show little variation, as do most other characters.

The species belongs to a complex of small species that occur along the northern and western margins of South America from Panama to Trinidad and Peru. Most species in the group have conspicuous dorsal setae, at least on the elytra, and in major males the majority of species have the horns on the vertex connected by a reasonably distinct ridge or carina. Within this complex *transisthmius* is most closely related to *O. ophion confusus* Boucomont and to *O. nabelecki* Balthasar, both occurring in Ecuador and Colombia (these two may be synonymous). These latter forms average at least 1 mm larger, the head of major males is more distinctly punctate, the horns are bowed inwardly, in some cases almost encircling the pronotal protuberance. Pronotal color is usually a distinct green, the elytral lines are less distinctly marked, and the pygidial punctures are more feebly developed. All of the above characters seem to separate the South American forms from the Panamanian *transisthmius*.

8. *Onthophagus marginicollis* Harold

Figs. 194, 195

Onthophagus marginicollis Harold, 1880, p. 31.

Type or cotype, Paris. Not seen.

Length 4.5 to 6.0 mm. Dorsal color: head brown to black, when black frequently with metallic reflections. Pronotum with margins, particularly lateral ones, tan to brown. Median third to four-fifths of pronotum very dark brown to black, if black frequently with faint greenish or metallic cast. Each elytron with sutural third, fifth, and seventh discal intervals dark brown to black, the intervening intervals (i.e., second, fourth, etc.) always lighter in color, tan to brown. Pygidium tan to brown, area near midline frequently darker. Pronotal surface moderately, closely punctate, the punctures separated by from one to three diameters, more widely spaced in male; punctures smaller medially. Pronotum with lateral punctures in male and all punctures in female each with a short inconspicuous, pale seta. Elytral surface with stria represented by the usual double line interrupted by shallow punctures separated by four to five diameters; intervals flat, granular, minutely punctate in male or coarsely punctate in female, the punctures of the latter each with a fine seta. Pygidium coarsely punctate-setose, surface in basal third between punctures dull. Metasternum between coxae with scattered coarse punctures only in lateral third adjacent to coxae, median third largely impunctate, smooth and shining, not cariniform anteriorly. Ventral surfaces of middle and hind femora with scattered coarse punctures mostly restricted to apical halves.

MALE. Major form (Fig. 194): clypeus strongly reflexed in anterior third, margin finely arcuate. Posterior half of clypeus nearly flat, transversely punctate-rugose; posterior margin of clypeus delimited by a low, nearly straight transverse carina. Gena with margin slightly expanded beyond line of clypeal margin. Frons and vertex moderately punctate; vertex with U-shaped carina which forms long cylindrical horn above and behind each eye (Fig. 194). Pronotum with median protrusion delimited on each side by smooth indentation for reception of horn on vertex. Fore tibia similar to that of female and noticeably elongate. Minor form: clypeus less strongly reflexed, posterior clypeal carina more elevated, horns of carina on vertex reduced or absent in extreme cases, pronotal protrusion greatly reduced, in some cases obsolete.

FEMALE (Fig. 195). Head similar to minor male, the carina of vertex broadly arcuate, of nearly uniform height, horns lacking. Pronotum in large specimens with a distinct antero-median protrusion rising vertically beyond anterior margin, terminating laterally on each side in a slightly produced rounded knob, the knob almost directly beyond inner margin of eye. In small females this protrusion may be almost totally lacking.

MATERIAL EXAMINED. PANAMA, 127 specimens from: CANAL ZONE - Ancon; Fort Kobbe; Frijoles; Rio Ciricito. CHIRIQUI PROV. - David; Galera de Chorcha; Remedios; Volcan de Chiriqui. COCLE PROV. - Aguadulce; El Valle. PANAMA PROV. - Cerro Campana; Maje; Panama City; Rio La Jagua. VERAGUAS PROV. - Los Algarrobos. COLLECTION DATES: January, March, May, June, July, August, September, December.

OTHER COUNTRIES, 58 specimens from: MEXICO, GUATEMALA, EL SALVADOR, NICARAGUA, COSTA RICA, COLOMBIA, GUYANA, CUBA.

REMARKS. This species has been captured under bark, and at cow, horse, human, and tapir feces. It occurs in open pastures, scrub, and open secondary forest at low and middle elevations.

9. Onthophagus lebasi Boucomont

Figs. 196, 197

Onthophagus lebasi Boucomont, 1932, pp. 308, 326.

Type, London. Examined.

Length 4.5 to 5.5 mm. Dorsal color: head black with green or cupreous reflections. Pronotum tan to brown on lateral thirds, median longitudinal third darker, often greenish black; dark median band often abruptly widened at middle. Elytra brown to dark brown, areas near striae sometimes slightly darker. Pygidium same shade of brown as sides of pronotum. Surface of pronotum coarsely punctate, punctures usually separated by less than one diameter, most punctures bearing a distinct, erect, tan seta; surface between punctures very finely shagreened, moderately shining. Elytral intervals, except for sutural one, with two to three rows of small punctures, each puncture with a raised granule anteriorly, an erect tan seta arising from each puncture. Pygidium coarsely punctate-setose, surface between shining. Metasternum and ventral surfaces of middle and hind femora with fairly evenly scattered, coarse, setose punctures.

MALE. Major form (Fig. 196): clypeal margin relatively evenly arcuate and only moderately reflexed; margin of gena only slightly irregular at junction. Clypeal surface flat with a few scattered punctures; clypeal carina absent; frons and vertex nearly flat, the posterior portion of vertex rising to transverse plate-like carina slanted back against pronotal margin, the carina anteriorly arcuate medially; on each side lateral terminus elevated, forming small horn or tubercle. Pronotum unmodified (same shape as female), slightly swollen near anterior margin. Fore tibia elongated, inner apex conical and somewhat extended, lacking distinct tuft of setae. Minor form not seen.

FEMALE (Fig. 197). Clypeus feebly reflexed laterally, more so anteriorly. Median edge nearly straight with sides arcuate; surface punctate-setose, sometimes transversely rugose; posterior clypeal carina present, margin of gena continuing arcuate curvature of clypeal margin. Vertex posteriorly with low arcuate carina, carina highest medially, surface before and behind carina with scattered, coarse, setose punctures.

MATERIAL EXAMINED. PANAMA, 3 specimens from: CANAL ZONE - Barro Colorado Island; Palo Seco (0.5 mi. S). COLLECTION DATES: February, May, June.

OTHER COUNTRIES, None.

REMARKS. This species has been taken at howler monkey and tapir feces.

10. Onthophagus chryses Bates

Fig. 198

Onthophagus chryses Bates, 1887, p. 76.

Cotypes, London and Paris. London specimens examined.

Length 4.9 to 5.6 mm. Dorsally (Panamanian form) reddish, pronotum dark brown to black with very strong greenish gold reflections. Elytra reddish tan to reddish brown with suture and sometimes wide median transverse band greenish. Pygidium brown to dark brown, usually with green or gold reflections. Head and pronotum with small distinct punctures, frequently separated by four to six diameters; each puncture centrally with minute brown seta, length of seta not exceeding diameter of puncture; surface between punctures very smooth, polished, shining. Elytra with striae feebly indicated by scarcely depressed double line interrupted by shallow punctures two to three diameters apart; intervals flat, most with one or two irregular rows of minute punctures, setae not evident, surface between punctures slightly irregular, polished, shining. Pygidium with well separated, moderate sized punctures, most separated by approximately one diameter; each puncture usually with minute central seta. Metasternum between middle coxae with scattered coarse punctures, punctures lacking only near faintly impressed midline, surface between punctures and along midline smooth and shining. Middle and hind femora with scattered, distinctly separated, coarse, setose punctures distributed over most of ventral surface, surface between punctures shining.

MALE. Major form (Fig. 198): clypeus anteriorly strongly transversely reflexed; reflexed portion approximately two-thirds width of clypeus, nearly vertical with edge very broadly, shallowly, emarginate. Sides of clypeus behind reflexed portion distinctly divergent, feebly arcuate, side of gena arcuately expanded beyond line of clypeal margin. Surface of clypeus, frons, and vertex lacking any indication of carina; moderately punctate, punctures separated by a distance of one or two diameters. Some punctures on clypeus and genae, particularly lateral ones, with fine setae, surface between smooth. Pronotum anteriorly behind head trituberculate; tubercles directed anteriorly, delimited by longitudinal concavities between (Fig. 198); summit of tubercles rounded, remainder of pronotum evenly convex. Fore tibia distinctly elongate with large apical tuft of setae at base of spur. Minor form: not seen but probably the reflexed portion of clypeus and pronotal tubercles reduced in development and possibly carina, as described for female, evident on head.

FEMALE. Clypeus weakly reflexed laterally, moderately so anteriorly; anterior third of margin broadly, shallowly, emarginate. Surface of clypeus transversely rugose, clypeal-frontal carina low, of nearly uniform height. Gena with margin flared slightly beyond line of clypeal margin. Vertex with low, slightly sinuous transverse carina; carina in median two-thirds of nearly uniform height, outer portion on either side abruptly sloping downward to posterior inner edge of eye. Pronotum with anterior portion immediately behind margin very feebly trituberculate, swellings and indentations sometimes only visible with proper lighting. Fore tibia unmodified, lacking tuft of setae.

MATERIAL EXAMINED. PANAMA, 4 specimens from: CHIRIQUI PROV. - Boquete; Bugaba; Cerro Punta. VERAGUAS PROV. - Potrerillos. COLLECTION DATES: January, March, June.

OTHER COUNTRIES, 2 specimens from: COSTA RICA.

REMARKS. This species has been recorded from human feces.

11. Onthophagus coscineus Bates

Figs. 199, 200

Onthophagus coscineus Bates, 1887, p. 79.

Cotypes, London (1 female) and Paris (pair). Examined.

Onthophagus digitifer Boucomont, 1932, p. 319. NEW SYNONYMY.

Type, Dresden (?). Not seen.

Length 2.5 to 4.1 mm. Dorsally dull brown to black; in profile with conspicuous, erect tan setae; head (Fig. 200) with close, simple, large punctures; pronotal punctures with contiguous, raised, shining margins; bottom of punctures flat, dull, granular with central granule at base of seta shining. Elytral striae not impressed, represented by doubled shining line interrupted by shallow punctures; intervals flat, dull, shagreened, with scattered setae, a small raised granule at base of each seta. Pygidium obsoletely punctate-setose, surface dull, shagreened or very finely granular. Metasternum and ventral surfaces of all femora with numerous coarse punctures, surface between punctures smooth and shining.

MALE. Major form (Fig. 199): clypeus broadly arcuate laterally, reflexed and broadly emarginate anteriorly. Margin of gena continuing arcuate line of clypeal margin. Clypeal-frontal carina absent; carina of vertex straight, low, of uniform height between anterior fourth of eyes; vertex posterior to carina as heavily punctate as frons and genae. Pronotum with small, anteriorly arcuate protuberance medially just posterior to anterior margin; face and upper edge shining, remainder of pronotum dull, contiguously punctate. Fore tibia slightly elongated, lacking apical tuft of setae. Minor form: clypeal margin less reflexed; pronotal protrusion very feebly developed; fore tibia not elongated.

FEMALE. Clypeus as in male except straight, low clypeal-frontal carina present, other characters including carina of vertex as described for male; pronotal protrusion feebly developed or absent.

MATERIAL EXAMINED. PANAMA, 85 specimens from: CANAL ZONE - Ancon; Barro Colorado Island; Cocoli; Coco Solo; Frijoles; Gatun; Madden Forest; Pipeline Road; Summit Park. CHIRIQUI PROV. - Rovira. PANAMA PROV. - Cerro Campana. VERAGUAS PROV. - Potrerillos. COLLECTION DATES: Every month of the year.

OTHER COUNTRIES, 16 specimens from: COSTA RICA, COLOMBIA, ECUADOR.

REMARKS. Cotypes of coscineus Bates and specimens determined by Boucomont as digitifer have been examined. All specimens seemingly represent one species; hence digitifer is placed in synonymy.

Specimens of coscineus have been taken at dog, howler monkey, human, peccary, and tapir feces. On Barro Colorado Island the species is active during the period from 1000 to 1400 hours, and occurs in fairly uniform numbers throughout the year. The species in Panama is limited to the central lowland moist forests.

12. Onthophagus dicranius Bates

Fig. 201

Onthophagus dicranius Bates, 1887, p. 72.

Cotypes, London and Paris. London specimens examined.

Length 4.5 to 6.0 mm. Dorsally uniform tan to dark brown; middle and hind femora centrally pale, yellowish; remainder of ventral surfaces similar to dorsum in color; dorsum heavily punctate, most punctures each with very minute, inconspicuous seta, setae on elytra most readily visible; all dorsal punctures, including those on pygidium, shallow, bottoms flattened, usually feebly ocellate; surface between punctures shining except on pygidium where finely shagreened. Metasternum and ventral surfaces of middle and hind femora with scattered small punctures, surface between punctures smooth and shining.

MALE. Major form (Fig. 201): clypeus with anterior median sixth or seventh of margin vertically reflexed into a transversely flattened parallel-sided, apically truncate horn, the horn approximately as high as wide; remainder of clypeal margin evenly arcuate and moderately reflexed, clypeal surface medially obsoletely punctate, shining; remainder of head heavily, closely punctate. Margin of gena continuing arcuate line of clypeal margin; head lacking any indication of carinae. Pronotum in anterior third with an elongate longitudinal carina on either side close to midline, summit of each carina obtusely angled at anterior third of pronotum, thence extending downward and slightly converging anteriorly toward midline; carinae impunctate, remainder of pronotum closely punctate, evenly convex. Fore tibia slightly elongated, lacking distinct tuft of setae at apex. Minor form: clypeal horn reduced to rounded elevation, width not greatly reduced; pronotal carinae reduced in height, usually evident; fore tibia similar to females.

FEMALE. Clypeus anteriorly sharply bidentate, emargination V-shaped, teeth acute, moderately reflexed; remainder of margin not or feebly reflexed. Head punctate, slightly convex medially, lacking any indication of carinae. Pronotum evenly convex, anterior seventh of midline impunctate, smooth and shining, remainder of pronotal surface closely punctate.

MATERIAL EXAMINED. PANAMA, 8 specimens from: CANAL ZONE - Barro Colorado Island. CHIRIQUI PROV. - Bugaba; Hartmann's Finca, 1500 m. COLLECTION DATES: May, June, September.

OTHER COUNTRIES, 4 specimens from: MEXICO, BELIZE.

REMARKS. The species has been taken from rotting fruit of Gustavia sp. and at human feces.

13. Onthophagus landolti Harold

Fig. 202

Onthophagus landolti Harold, 1880, p. 34.

Type or cotype, Paris. Examined.

Length 4.2 to 6.0 mm. Head and pronotum dorsally black with distinct greenish reflections, anterior pronotal margin often narrowly edged with brown. Elytra largely greenish black, frequently with brown spots near basal and apical margins. Pygidium occasionally entirely greenish black, more frequently greenish black centrally, brown laterally and sometimes apically. Dorsal surface of head and pronotum with numerous setose punctures, surface between shining. Elytral intervals shallowly punctate with one row of punctures along outer edge of interval, most punctures with pale, erect setae. Pygidial surface coarsely punctate-setose. Metasternum with distinctly separated, coarse punctures relatively uniformly distributed, separated by approximately one diameter. Ventral surfaces of middle and hind femora with similar coarse, setose punctures.

MALE. Major form (Fig. 202): clypeus anteriorly abruptly reflexed, very shallowly, broadly emarginate medially; posterior two-thirds of clypeus nearly flat with a few scattered coarse punctures; carina absent. Gena distinctly expanded. Vertex largely impunctate, carina vaguely indicated above and behind each eye. Pronotum with median, anteriorly projecting, rounded tubercle overhanging anterior margin; pronotum otherwise evenly convex. Fore tibia considerably elongated with a tuft of yellowish setae at the base of conical apex. Minor form: clypeus scarcely reflexed anteriorly, carina on vertex complete; anterior pronotal protuberance greatly reduced; fore tibia only slightly elongated.

FEMALE. Clypeus slightly reflexed laterally, more so anteriorly, median edge broadly emarginate; surface rugose, punctate-setose; posterior clypeal carina present. Gena only slightly expanded; vertex posteriorly with arcuate carina, highest medially. Surface of frons and vertex coarsely punctate-setose. Pronotum with anterior swelling obsolete or vaguely indicated and contiguous to anterior margin.

MATERIAL EXAMINED. PANAMA, 81 specimens from: CANAL ZONE - Cocoli. CHIRIQUI PROV. - Galera de Chorcha; Hartmann's Finca, 1200 m; Las Lagunas; Santa Clara. COCLE PROV. - El Valle. PANAMA PROV. - Cerro Campana; Rio La Jagua. VERAGUAS PROV. - Potrerillos. COLLECTION DATES: January, February, March, April, May, August, December.

OTHER COUNTRIES, 122 specimens from: MEXICO, BELIZE, EL SALVADOR, COSTA RICA, COLOMBIA.

REMARKS. This species has been captured at horse, human, and tapir feces. It usually is found in forest and scrub areas below 1200 m.

14. Onthophagus atrosericeus Boucomont

Fig. 203

Onthophagus atrosericeus Boucomont, 1932, pp. 311, 320.

Type, Paris (?). Not seen.

Length 5.5 to 7.5 mm. Dorsally dull black, non-punctate surfaces finely granular; head, elytra and pygidium impunctate or only feebly punctate; pronotal disc distinctly punctate, punctures large, margins a conspicuous shining ring, bottom of puncture flat, each puncture centrally with erect black seta; punctures nearly contiguous laterally, separated by one to two diameters at center of disc, surface between punctures granular; anterior pronotal angles on each side rounded, adjacent lateral margin frequently slightly inwardly arcuate. Elytra with striae represented by distinct lines, intervals granular, flat, most with two slightly irregular rows of erect setae. Pygidium with scattered erect setae, surface granular. Metasternum and ventral surfaces of all femora with scattered small to moderate sized punctures, surface between mostly smooth and shining.

MALE. Major form (Fig. 203): clypeus abruptly reflexed in anterior third, reflexed margin slightly emarginate, remainder of head flat to slightly convex, impunctate; margin of gena arcuately produced beyond line of clypeal margin. Pronotum with large, anterior, median protuberance rising vertically behind anterior margin, upper edge of protrusion shining, smooth, slightly depressed near midline; vertical face finely punctate, shining. Fore tibia greatly elongated, a tuft of setae present beside apical spur. Minor form: clypeus feebly reflexed, very broadly, shallowly emarginate, gena only slightly expanded; carina of vertex feebly indicated on either side of midline between eyes; pronotal protuberance a fine, raised, shining, arcuate carina just behind anterior margin; fore tibia not unusually long, similar to female.

FEMALE. Clypeus feebly reflexed, broadly emarginate; surface mostly closely punctate and shining; only shining carina on vertex present, the short, straight carina positioned midway between eyes; vertex impunctate; pronotum with median protrusion obsolete, represented by a slightly swollen, shining area adjacent to median anterior margin.

MATERIAL EXAMINED. PANAMA, 68 specimens from: CHIRIQUI PROV. - Baldwin Forest, 1760 m; Cerro Punta (2 km E - 2000-2200 m); Cerro Punta (5 km ESE - 2600 m). COLLECTION DATES: May, June.

OTHER COUNTRIES, described from: COSTA RICA.

REMARKS. This species has been found at horse dung and human feces. The distribution of atrosericeus is seemingly restricted in Panama to the forests above 1700 m elevation.

15. Onthophagus cyanellus Bates

Fig. 204

Onthophagus cyanellus Bates, 1887, p. 81.

Cotypes, London and Paris. London specimens examined.

Length 7.5 to 10.5 mm. Color dorsally dull black, usually with faint bluish tinge. Head and pronotum finely, closely punctate; pronotal punctures, particularly laterally, frequently with minute erect setae, setae scarcely longer than width of puncture, slightly longer in females; pronotal surface between punctures finely granular. Elytral intervals flat with two or three irregular rows of minute tubercles, a fine, short, erect seta arising from base of each tubercle, surface between finely granular; elytral striae represented by feebly impressed shining lines interrupted by large shallow punctures. Pygidium opaque with scattered small punctures, many with minute setae, surface between granular. Metasternum between middle coxae with small to large punctures, midline finely impressed except in anterior fifth. All femora with ventral surfaces with mixture of large and small punctures.

MALE. Major form (Fig. 204): clypeus broadly transverse, over half of total surface reflexed, laterally broadly sinuously arcuate to rounded angles. Lateral clypeal margins short, gena expanded, margin of gena three to four times length of lateral clypeal margin. Surface of head moderately to coarsely punctate, occasionally rugose. Clypeal-frontal carina absent, carina of vertex bow-shaped, vaguely indicated medially, terminating laterally on each side in a small rounded tubercle near inner posterior margin of eye. Pronotum with anterior angles acute, laterally with margin obtusely angled at anterior third, arcuate behind angle, the area between angle and median pronotal protuberance shallowly, broadly concave. Pronotal protuberance truncate anteriorly, sides diverging arcuately to small tubercle on each side above pronotal fossa; summit of protuberance often faintly indicated on each side; surface anteriorly shining between punctures. Posterior half of pronotum dull, surface between punctures granular. Fore tibia distinctly elongated, a few apical setae present but distinct tuft lacking. Minor form: clypeus with entire margin feebly, nearly uniformly reflexed, surface transversely rugose. Both clypeal-frontal carina and carina of vertex feebly indicated. Frons and vertex closely punctate, often transversely rugose. Pronotum lacking abrupt angle laterally, central protuberance feebly elevated, slightly more shining than surrounding convex area of pronotum. Fore tibia not elongated.

FEMALE. Clypeal margin arcuate, more broadly so anteriorly, narrowly evenly reflexed, surface transversely rugose. Clypeal-frontal carina distinct, low, of uniform height, anteriorly arcuate. Frons and gena closely, nearly contiguously punctate. Carina of vertex with median third more anterior in position, the carina slightly sinuous, of nearly uniform height, terminating on each side near posterior inner margin of eye. Pronotum with anterior protrusion as described for male minor, feeble protuberance shining, remainder of pronotum opaque.

MATERIAL EXAMINED. PANAMA, 141 specimens from: CHIRIQUI PROV. - Baldwin Forest; Boquete; Bugaba; Cerro Punta, 5750 ft., 6250 ft.; Cerro Punta (2 km E, 2200 m); Finca Lerida; Hartmann's Finca, 1500 m, 1550 m; Volcan de Chiriqui. COLLECTION DATES: January, March, May, June, October.

OTHER COUNTRIES, 56 specimens from: MEXICO, NICARAGUA, COSTA RICA.

REMARKS. This species has been captured at carrion, and at horse, human, and tapir feces. The species occurs in moist forests at elevations between 1000 to 2500 m.

16. Onthophagus mirabilis Bates

Figs 205-207

Onthophagus mirabilis Bates, 1887, p. 74; Howden, 1973b, p. 334.
Type, Paris. Examined.

Onthophagus orphnoides Bates, 1887, p. 75. NEW SYNONYMY.
Cotypes, London and Paris. Series examined.

Length 7 to 12 mm. Dorsally dark brown to brownish black, glabrous; head, pronotum, elytral intervals and pygidium with close to contiguous, moderate-sized punctures, surface between shining; elytral striae distinctly impressed. Metasternum between middle coxae more strongly punctate laterally, number of punctures variable, smaller specimens having more and larger punctures. Ventral surfaces of middle and hind femora with scattered minute to coarse punctures, density and size variable, but more numerous in small specimens, particularly small females. Sexual dimorphism unusually pronounced; characters of each sex also strongly influenced by allometric (heterogenic) growth.

MALE. Major form (Fig. 205): clypeal margin converging to anterior, median, almost vertical horn, the horn thickened near apex and narrowly, deeply emarginate; clypeus otherwise almost flat, feebly punctate. Junction of gena and clypeal margin obtusely angled, sides of genae nearly parallel. Frons and vertex feebly convex, not carinate or horned. Pronotum with conspicuous conical, anteriorly projecting median horn (Fig. 205), the horn extending over head to middle of clypeus and apically bifurcate. Fore tibia somewhat elongated and with conspicuous tuft of setae at base of apical spur. Minor form (Fig. 206): both clypeal and pronotal horns reduced to small tubercles; often some slight indication on clypeal horn of an emargination; fore tibiae not elongated, similar to female.

FEMALE (Fig. 207). Large specimens (described by Bates, 1887, under the name O. orphnoides): clypeus anteriorly bidentate, the two teeth reflexed and separated by U-shaped emargination; clypeal surface otherwise flat and closely punctate; posterior clypeal carina obsolete, represented by fine ridge. Vertex on each side near inner edge of eye with low tubercle; surface punctate before, impunctate behind. Pronotum with acute conical tubercle or horn medially at anterior margin; pronotum medially longitudinally concave, highest at obtuse angle either side of concavity at anterior third; concavity largely impunctate, remainder of pronotum punctate. Small specimens have clypeal teeth, tubercles on vertex, and pronotal horn all reduced in size; pronotal concavity very feebly indicated, entire surface heavily punctate.

MATERIAL EXAMINED. PANAMA, 10 specimens from: CHIRIQUI PROV. - Baldwin Forest; Hartmann's Finca, 1200 m; Las Lagunas; Santa Clara; Volcan de Chiriqui, 4000 ft. COLLECTION DATES: May, June, July.

OTHER COUNTRIES, 1 specimen from: ECUADOR.

REMARKS. It is not surprising that Bates described the two sexes of this species under different names, although he did note that the specimens of orphnoides were probably all females. Only recently have both sexes been taken in one locality and enough specimens have become available to indicate that the name mirabilis represents the male and orphnoides the female of the same species.

The species has been taken at light, on carrion, and at human feces. A few specimens have been collected by sweeping over a forest trail at dusk in a wet valley forest 2 km west of Cerro Punta.

17. Onthophagus sharpi Harold

Fig. 208

Onthophagus sharpi Harold, 1875, p. 138.

Cotypes, Paris. Not seen.

Length 6.5 to 8.8 mm. Dorsally shining brownish black to black with faint purple or blue cast; pronotum minutely punctate, lateral areas of pronotum and head more distinctly so; lateral pronotal margins evenly arcuate. Dorsal setae absent. Elytron with strial lines impressed, the lines regularly interrupted by shallow punctures; intervals flat to slightly convex, smooth occasionally with scattered very minute punctures, surface shining. Pygidium moderately punctate, the punctures separated by one to two diameters, most punctures with a minute seta; surface between punctures smooth and shining. Metasternum and ventral surfaces of all femora with scattered small to moderate punctures, surface between punctures smooth and shining.

MALE. Major form: clypeus (Fig. 208) with erect horn arising vertically at median anterior edge, expanding in outer two-thirds to form a wide arcuate T-shaped plate nearly truncate dorsally and approximately equal in width to base of clypeus, clypeus on either side of horn with edge not reflexed, almost transverse to abruptly rounded lateral angle, posteriorly with clypeal sides nearly parallel to junction with expanded gena. Surface of frons and vertex centrally feebly convex, lacking any indication of carinae or horns. Pronotum very slightly flattened in anterior median third, posterior summit with flattened area often with vague median tubercle; flattened area more distinctly punctate than remainder of disc, pronotum otherwise evenly convex. Fore tibia of approximately same length as female, but with large distinct brush of apical setae. Minor form: clypeal horn reduced to evenly rounded vertically reflexed anterior edge, margin of clypeus and gena otherwise arcuate to slightly sinuate, gena not noticeably produced. Pronotum lacking flattened area, evenly convex, somewhat more distinctly punctate.

FEMALE. Clypeus anteriorly strongly bidentate, median emargination narrowly V-shaped. Tooth on either side acute, moderately reflexed, remainder of margin on each side evenly arcuate, arcuate margin continuing to posterior edge of gena. Clypeal-frontal carina feebly indicated in median half, occasionally obsolete, vertex lacking carina. Pronotum evenly convex, moderately punctate. Fore tibia lacking apical brush of hair.

MATERIAL EXAMINED. PANAMA, 196 specimens from: BOCAS DEL

TORO PROV. - Rio Changuinola. CANAL ZONE - Barro Colorado Island; Frijoles; Madden Forest; Pipeline Road; Rio Ciricito. CHIRIQUI PROV. - Boquete; Bugaba; Hartmann's Finca, 1300 m. PANAMA PROV. - Cerro Campana. COLLECTION DATES: February, April, May, June, July, August, September, December.

OTHER COUNTRIES, 18 specimens from: GUATEMALA, COSTA RICA, ECUADOR.

REMARKS. *Onthophagus tapirus* Sharp (1877, p. 130) was described from Nicaragua and is extremely close, if not identical, to *sharpi*. The species *tapirus* supposedly differs from *sharpi* in averaging slightly smaller, lacking the conspicuous flattened area on the pronotum of the males and having a greenish coppery cast. There is also supposedly a difference in clypeal shape but this varies so much with heterogonic growth that it is an extremely difficult character to assess. We have seen specimens from Panama that might be considered to be *tapirus* but these were taken at the same time and place where typical *sharpi* were found. The group should be carefully studied but at present all specimens that we have seen from Panama we would place under the name *sharpi*.

This species has been recorded from fresh *Scheelea* sp. husks, fermented palm fruits, rotting fruit of *Gustavia* sp., *Maguira* sp. fruit, rotting bananas, spadix of *Philodendron* sp., and fallen flowers of *Gustavia* sp.; on tree trunk, leaf surfaces, in or under nest of *Trigona cupira*, and at light; in or on Agaricaceae, *Polyporus tenuis*, *Favolus* sp., and fungus mold on log; at rat and other carrion, and under skin and bones of coati; on howler monkey and human feces; and has been bred from *Heliconia mariae* and *H. pendula*.

On Barro Colorado Island *sharpi* is nocturnally active during the period from 1600 to 0800 hours and is most abundant during the early and mid-wet season. It probably has the broadest feeding niche of any of the Scarabaeinae in Panama.

18. *Onthophagus praecellens* Bates

Fig. 209

Onthophagus praecellens Bates, 1887, p. 70.

Cotypes, London and Paris. London specimens examined.

Length 4.7 to 7.5 mm. Dorsally shining brownish black to black, usually with strong green or cupreous cast. Head variably punctate, pronotum with small, fairly uniformly distributed punctures separated by two to five diameters, each puncture frequently with minute, central seta; setal length approximately equal to diameter of puncture; surface between punctures shining, smooth to finely shagreened. Elytral striae feebly impressed, with double line interrupted by shallow punctures separated by one to two diameters; intervals nearly flat, with scattered minute punctures, surface shagreened, moderately shining; setae on intervals present only near margins. Pygidium with poorly defined, close punctures, surface in and between punctures dull, shagreened or granular. Metasternum between middle coxae with scattered coarse punctures except near midline, surface shagreened, feebly shining. Ventral surfaces of middle and hind femora largely impunctate, smooth (extreme apex may have one or two punctures).

MALE. Major form (Fig. 209): anterior median clypeal horn rising nearly vertically and expanding to form wide, posteriorly directed U-shaped apex, each arm of "U" directed toward adjacent eye, terminating near posterior edge of clypeus; margin of clypeus on either side of horn sinuously expanded to upwardly flared, angulate junction with margin of gena; margin of gena extending directly toward posterior, turning inward opposite eye; shallowly concave surface of clypeus with unevenly scattered punctures; clypeal-frontal carina absent; carina of vertex represented by small acutely pointed tubercle on either side near posterior inner margin of eye; vertex between tubercles with feeble depression and ridge on either side of smooth midline. Pronotum in anterior third with triangular, longitudinal upright plate on either side of midline, outer angle of plate directed anteriorly and often overhanging vertex of head; apices of plates separated by approximately 0.5 mm. Fore tibia elongated, with apical tuft of setae at base of spur. Minor form: clypeus with sides evenly converging anteriorly to bluntly acuminate, feebly reflexed, apex; remainder of head nearly flat, gena not flared; clypeal-frontal carina absent; tubercles on vertex greatly reduced and rounded but still evident; pronotal plates reduced to rounded tubercles; fore tibia unmodified.

FEMALE. Differing from male as follows: clypeus arcuately converging to emarginate, bidentate, feebly reflexed apex; clypeal surface transversely rugose; clypeal-frontal carina very low, usually indicated across entire width of clypeus to margins; vertex with broadly conical tubercle on either side nearly equidistant between midline and eye; pronotal plates greatly reduced, but summit angulate, separated from opposite summit by approximately 0.3 mm, this varying slightly depending on size of female. Fore tibia lacking apical tuft of setae.

MATERIAL EXAMINED. PANAMA, 209 specimens from: CANAL ZONE - Barro Colorado Island; Cabima; Coco Solo; Madden Forest; Pipeline Road. COCLE PROV. - El Valle, 2600 ft. COLON PROV. - Alhajuela. CHIRIQUI PROV. - Cerro Pando; Las Lagunas. COLLECTION DATES: Every month of the year.

OTHER COUNTRIES, 31 specimens from: GUATEMALA, COSTA RICA, COLOMBIA, TRINIDAD.

REMARKS. This species has been captured at fermented palm fruits, in wet debris of small stream, and in forest floor leaf litter; at agouti, armadillo, bird, coati, howler monkey, lizard, peccary, rat, and tamandua carrion; and on coati, howler monkey, human, opossum, spider monkey, and tapir feces.

On Barro Colorado Island, praecellens is active during the period from 0700 to 1800 hours. It occurs in all months of the year but is most abundant during the late wet season and early dry season, and is equally abundant on both feces and carrion.

19. Onthophagus belorhinus Bates

Fig. 210

Onthophagus belorhinus Bates, 1887, p. 69.

Cotypes, London and Paris. London specimens examined.

Length 6.0 to 9.5 mm. Dorsally dark brown, brownish black or black, occasionally with bluish reflections; head and pronotum shining, elytra dull; dorsal setae absent except sometimes along margins of elytra. Head and pronotum finely to moderately punctate, pronotal punctures small, on disc separated by two to four diameters. Elytral striae represented by shining double line interrupted by shallow punctures; elytral intervals frequently impunctate or with extremely minute punctures, surface finely granular. Pygidium with moderate-sized punctures, the punctures often poorly delimited, pygidial surface dull, opaque. Metasternum between middle coxae with small to moderate-sized punctures near coxae, minutely punctate and finely shagreened medially. Middle and hind femora with a few coarse punctures in apical third on vertical surface, remainder of surface smooth or finely punctate.

MALE. Major form (Fig. 210): clypeus with anterior median edge (about 0.3 mm wide) forming horn extending vertically for 0.5 to 0.7 mm, thence bifurcating into two diverging, posteriorly directed branches, each pointed toward adjacent eye, the branch terminating in an acute point midway between anterior and posterior margins of head; anterior clypeal margin on either side of horn truncate, broadly flared to abruptly arcuate sides; gena elongate, side nearly straight, slightly divergent to abrupt angle in line with eye; surface of clypeus and frons broadly, longitudinally concave; clypeal-frontal carina absent; carina of vertex represented by long, cylindrical, bowed horns laterally enclosing an almost conical, median bituberculate pronotal prominence; fore tibia elongated with apical tuft of setae at base of spur. Major form, moderate development; clypeus with anterior median vertical horn (Fig. 210) rounded at summit, apex neither bifurcate nor bent posteriorly, sides of clypeus on either side evenly arcuate to gena, not laterally flared, margin of gena in line with clypeal margin; horns on vertex and fore tibia only very slightly reduced in length; pronotum more distinctly bituberculate at summit. Minor form: clypeus feebly reflexed and acuminate anteriorly, horns on vertex reduced to conical tubercles but with no carina between; pronotal prominence represented by two distinct, slightly longitudinally elongate, rounded tubercles, one on either side of narrow median longitudinal concavity; fore tibia similar to female, lacking apical tuft of setae.

FEMALE. Differing from male in the following characters: sides of clypeus nearly straight, converging to narrowly reflexed bidentate apex, the apex moderately emarginate between rounded teeth; clypeal surface transversely rugose; clypeal-frontal carina represented by low ridge terminating on each side at junction with gena; carina of vertex represented on each side by a short, fairly stout, upright horn (in small females horn reduced to conical tubercle), vertex not carinate between horns; pronotum with two longitudinal tubercles as described for male minor. Fore tibia lacking apical tuft of setae.

MATERIAL EXAMINED. PANAMA, 48 specimens from: CHIRIQUI PROV. - Baldwin Forest; Boquete; Cerro Pando; Cerro Punta; Hartmann's Finca. PANAMA PROV. - San Isidro, 1600 ft. COLLECTION DATES: January, May, June, October, November, December.

OTHER COUNTRIES, 19 specimens from: MEXICO, EL SALVADOR, COSTA RICA, COLOMBIA, ECUADOR.

REMARKS. This species has been found at light, on rat carrion and on unknown carrion, and at horse, human, and opossum feces.

Ontherus Erichson

Ontherus Erichson, 1847, p. 107, Janssens, 1949, p. 15.

Type-species: *Ontherus didymus* Erichson, listed by Lucas, 1920.

Usually black, size moderate, 10 to 20 mm; scutellum not visible; elytron with eight striae (nine counting inflexed margin); mesosternum moderate in length, somewhat triangular, median area closely punctate; metasternum between middle coxae feebly to moderately narrowed anteriorly; abdomen with six sternites visible laterally, medially only three to five evident; abdomen along ventral midline shortened, thus compressing sternites; hind tibia gradually expanded to apex, not transversely carinate on outer margin; all tarsi with claws.

Key to species of *Ontherus*

1. Metasternum between middle coxae distinctly narrowed anteriorly, distinctly narrower than width of one coxa; pronotal midline not impressed 2
Metasternum between middle coxae only feebly narrowed anteriorly, approximately equal in width to that of one coxa; pronotal midline narrowly impressed in posterior half . . . . 3. *strius* n. sp.

2. Vertex adjacent to inner edge of eye concave; elytra approximately twice as long as pronotum . . . . 2. *didymus* Er.
Vertex adjacent to inner edge of eye at least slightly convex; elytra only slightly longer than pronotum . . . . 1. *brevipennis* Har.

1. Ontherus brevipennis Harold

Fig. 211

Ontherus brevipennis Harold, 1867b, p. 97.

Type, Paris. Not seen.

Length 11 to 14 mm. Anterior margin of clypeus arcuate, not emarginate medially. Frons (Fig. 211) with low transverse carina, termination tuberculate on each side; carina as wide as three-fourths of distance between eyes. Pronotum (Fig. 211) with inverted V-shaped swelling medially, adjacent to anterior margin. Metasternum with midline impressed for entire length. Posterior margin of hind femur with a small tooth at apical end. Parameres of genitalia each with a small acute tooth just below apex.

MATERIAL EXAMINED. PANAMA, 31 specimens from: CANAL ZONE - Black Tank Road. COLON PROV. - Portobelo, 1911, 1912. PANAMA REP. - no other data. COLLECTION DATES: February, July.

OTHER COUNTRIES, None.

REMARKS. All of the specimens seen lacked host data and only two of these were collected after 1912.

2. Ontherus didymus Erichson

Figs. 212, 213

Ontherus didymus Erichson, 1847, p. 108.

Type, Berlin (?). Not seen.

Length 11 to 20 mm. Anterior margin of clypeus shallowly emarginate medially. Frons tumid, varying from feebly bituberculate to distinctly horned, the upright horn (Fig. 213) bituberculate at transverse apex. Pronotum (Figs. 212, 213) varying from evenly convex (small specimens) to feebly bituberculate (females) to distinctly quadrituberculate, the lateral tubercles larger and slightly more anterior in position. Metasternum lacking impressed midline or midline feebly impressed only in posterior half. Hind femur of males lacking tooth or expanded flange near apex of hind margin. Parameres of genitalia with acute apices.

MATERIAL EXAMINED. PANAMA, 219 specimens from: CHIRIQUI PROV. - Baldwin Forest; Cerro Punta; 2 km W Cerro Punta, 1300 m, 1700 m; 2 km E Cerro Punta, 2200 m; Hartmann's Finca, 1300 m, 1500 m, 1550 m; Las Lagunas, 1360 m. COLLECTION DATES: January, May, June, July, October.

OTHER COUNTRIES, 35 specimens from: COSTA RICA.

REMARKS. This species has been captured at light; on unknown carrion; and at coati, horse, human, opossum, and tapir feces.

3. Ontherus strius n. sp.

Figs. 214-216

HOLOTYPE. Male, length 15 mm, greatest width 7.5 mm. Dorsally shining black. Clypeus (Fig. 214) anteriorly very feebly emarginate. Frons medially with small conical tubercle. Pronotum moderately punctate laterally, faintly tumid medially at anterior fifth, midline indented medially posterior to tumid area. Elytron with six striae between suture and humeral umbone, striae distinctly impressed and punctate, punctures separated by one to two diameters. Pygidium with complete marginal bead, surface punctate. Fore tibia with four distinct teeth on outer margin; apical tooth extended forward, nearly paralleling long axis of tibia. Hind femur unusually broad, dorsally flattened with hind margin expanded, particularly apically, the dorsal apical termination (Fig. 216) acutely angulate. Hind tibia with six or seven lateral serrations, inner margin with obtuse tooth at basal third; longest tibial spur longer than first two tarsal segments. Hind tarsus with basal segment nearly rectangular. Genitalia as in fig. 215.

ALLOTYPE. Female, length 13 mm, greatest width 7 mm. Differing from holotype in the following major characters: brown (teneral), tubercle on frons slightly smaller; fore tibia with apical tooth with curvature similar to penultimate tooth; hind femur lacking posterior expansion, a distinctive broad groove present ventrally, paralleling hind margin; hind tibia lacking obtuse tooth at basal third, tibia more slender; abdominal sternites less narrowed medially.

TYPE MATERIAL: Holotype, male, Panama, Canal Zone, Barro Colorado Island, 17.IX.1975, O. Young (Washington). Allotype, female, same locality as holotype, 16-20.II.1976, A. Newton, human dung trap (Cambridge).

PARATYPE: 1 male, same data as allotype (Howden).

REMARKS. The male paratype, except for the sexual differences, is the same size and color (also teneral) as the allotype. We have seen one (or two) closely related species from Napo Province, Ecuador, and from Distrito Federal, Brazil. The species name, strius, is based on the initials for the Smithsonian Tropical Research Institute.

Dichotomius Hope

Dichotomius Hope, 1838, p. 321; Martínez, 1951, p. 140 (complete synonymy).

Type-species: Copris boreus Olivier, by original designation.

Pinotus Erichson, 1847, p. 108.

Dark brown to black species (in Panama); size moderate (10 mm) to large (35 mm); clypeus usually at least slightly rugose laterally; scutellum not visible; elytron with eight striae; middle and hind tibiae gradually expanded to apices, lacking distinct transverse carina at outer third or half; middle tibia with two spurs; tarsi with claws present on all legs; mesosternum wide, middle coxae separated by distance greater than width of femur; abdomen with six sternites, at least first five not greatly narrowed medially.

Key to species of *Dichotomius*

1. First and second elytral striae not noticeably widened in apical third, not noticeably tomentose; size usually less than 24 mm 2
At least first and second elytral striae distinctly widened in apical third, widened area often brown, tomentose; size usually over 25 mm . . . . 1. *carolinus colonicus* (Say)

2. Metasternum with numerous setae; clypeus rounded or emarginate 3
Metasternum with few setae; clypeus medially abruptly notched 6

3. Pronotum with median posterior horn(s) or with median unevenly tumid or carinate transverse ridge 4
Pronotum lacking horns or ridges, disc evenly convex, or slightly declivous anteriorly 5

4. First tarsal segment on middle and hind legs strongly triangular, as wide as long; carina or horn on head highest medially . . . . 3. *satanas* (Har.)
First tarsal segment on middle and hind legs elongately triangular, approximately twice as long as wide; carina on head truncate or rounded . . . . 2. *nevermanni* (Lued.)

5. Metasternum laterally closely, setose-punctate; size moderate (16-21 mm) . . . . . 4. *agenor* (Har.)
Metasternum laterally with widely scattered punctures, setae sparse; size small (12-15 mm) . . . . 5. *inachus* (Erich.)

6. Hind femur with 4 to 10 scattered punctures on ventral surface; pronotum with coarse punctures separated by more than one diameter, surface between with minute secondary punctures . . . . 6. *femoratus* n. sp.
Hind femur punctate in apical half; pronotum moderately punctate, most punctures nearly contiguous . . . . 7. *gamboaensis* n. sp.

1. *Dichotomius carolinus colonicus* (Say)

Fig. 217

Copris colonica Say, 1835, p. 174.
Type, Cambridge or destroyed. Not seen.
Dichotomius carolinus colonicus (Say); Martínez, 1951, p. 140.

MALE. Length 19 to 34 mm, greatest width 14 to 18 mm. Black, often with the posterior third of discal striae brown, tomentose. Shape very convex, oval. Male majors (Fig. 217) with short upright clypeal horn central (at middle of clypeus), clypeus not or feebly emarginate. Pronotum punctate, with rounded, medially indented transverse swelling at posterior third; a short, abrupt carina present just anterior to lateral pronotal fovea; posterior marginal bead complete. Elytral striae fine and with small punctures anteriorly, inner two or more striae widened in apical third, tomentose. Metasternum laterally and along margins between middle coxae with numerous long setae.

FEMALE. Shape and variation in size similar to male, differing in the following major characters: low, transverse, apically truncate horn or tubercle present on vertex. Transverse pronotal swelling more distinctly trilobed and positioned in anterior third of pronotum; lateral pronotal carinae obsolete. Usually first five striae on each elytron posteriorly tomentose.

MATERIAL EXAMINED. PANAMA, 59 specimens from: CANAL ZONE - Frijoles. CHIRIQUI PROV. - Hartmann's Finca, 1200 m, 1300 m, 1500 m; Hato del Volcan; Las Lagunas; Los Pozos; Palo Santo; Santa Clara. COCLE PROV. - El Valle. COLON PROV. - Santa Rita Ridge. PANAMA PROV. - Cerro Campana. COLLECTION DATES: May, June, July, August, November.

OTHER COUNTRIES, 236 specimens from: UNITED STATES, MEXICO, BELIZE, GUATEMALA, EL SALVADOR, COSTA RICA.

REMARKS. In small specimens the horn on the head (in either sex) may be greatly reduced and the same is true for the transverse pronotal swelling. Generally the large size and the two to five brown tomentose strial areas in the posterior third of each elytron will readily distinguish colonicus from other Panamanian species in the genus.

Dichotomius c. colonicus has been captured in light traps, and at horse dung and human feces. It is most abundant in the early wet season and is found mostly at moderate elevations in forested areas.

2. Dichotomius nevermanni (Luederwaldt) New Combination

Fig. 218

Pinotus nevermanni Luederwaldt, 1935, p. 334.

Type, London (?). Not seen.

FEMALE (only specimen seen). Length 20 mm, greatest width 12.5 mm. Black, similar in shape and pronotal configuration to D. c. colonicus. Differing from colonicus in the following major characters. Head (Fig. 218) with low transverse carina extending across anterior edge of frons, carina nearly straight, of uniform height, vaguely tuberculate at lateral termination. Pronotum with four swellings, one on either side of midline at median half, one on each side above lateral fovea. Elytral stria simple, feebly punctate, first to fifth striae not widened apically, lacking tomentose areas.

MATERIAL EXAMINED. PANAMA, 1 specimen from: PANAMA PROV. - El Valle, 13.XI.1963, L.J. Bottimer, at light (Ottawa).

REMARKS. The single female specimen is similar to small colonicus. In his description of nevermanni, Luederwaldt (1935) based his description on a single female from Costa Rica. In his five line description he related the species to carolinus (colonicus). He stated that the metasternum lacks setae while in our female the metasternum has setae. Since setae can be lost (by abrasion, etc.) we are utilizing Luederwaldt's name. Only when more material becomes available and the type is examined can the name be applied with certainty.

3. Dichotomius satanas (Harold)

Fig. 219

Pinotus satanas Harold, 1867b, p. 98.

Type or cotype, Paris. Not seen.

Dichotomius satanas (Harold); Halffter and Matthews, 1966, p. 83.

MALE. Length 17 to 23 mm, greatest width 10 to 13 mm. Brownish black to black; shape elongate oval, very convex. Clypeus rounded or very feebly emarginate; clypeal horn (Fig. 219) transverse, anteriorly-posteriorly flattened, apically rounded, positioned medially in center of clypeus. Pronotal disc, except for lateral third, flattened; posterior edge of flattened area feebly swollen (male minor) or with a median, slightly anteriorly bent horn (Fig. 219) and a small tubercle on each side anterior to fifth stria; pronotal surface granular. Elytral striae shallow, moderately fine, punctures small; elytral intervals feebly convex, finely rugose or granulate. Metasternum with numerous long setae except near smooth, vaguely impressed median area.

FEMALE. Variation in size similar to male. Differing in the following major characters: vertex with small conical horn; pronotum with distinct bilobed median swelling, also on each side near base a small tubercle or swelling usually present (in larger females).

MATERIAL EXAMINED. PANAMA, 89 specimens from: BOCAS DEL TORO PROV. - Rio Changuinola. CANAL ZONE - Barro Colorado Island. CHIRIQUI PROV. - Hartmann's Finca, 1200 m, 1300 m, 1500 m; Las Lagunas. COLON PROV. - Santa Rita Ridge. DARIEN PROV. - Cerro Tacarcuna, 4800 ft. PANAMA PROV. - Cerro Campana; Altos (Isla) de Majé. COLLECTION DATES: Every month of the year.

OTHER COUNTRIES, 157 specimens from: MEXICO, BELIZE, GUATEMALA, COSTA RICA, COLOMBIA, ECUADOR, PERU.

REMARKS. In both sexes the horn on the head and the pronotal modifications may be greatly reduced in small specimens. The granular pronotal surface should suffice to distinguish the species from other members of the genus occurring in Panama.

This species has been recorded at rat and unknown carrion, and on coati, human, spider monkey, and tapir feces. On Barro Colorado Island, satanas is nocturnally active, particularly during the periods of 1800 to 2000 hours and from 2400 to 0600 hours. It has been recorded for all months except March, July, and October, with relative densities similar throughout the year. Teneral individuals have been recorded in April and November which suggests continuous reproductive activity. It occurs in moist forest at all elevations throughout Panama.

4. Dichotomius agenor (Harold) New Combination

Figs. 220, 221

Pinotus agenor Harold, 1869c, p. 141.

Type or cotype, Paris. Not seen.

MALE. Length 15 to 19 mm, greatest width 10 to 12 mm. Black, shining; shape (Fig. 220) oblong-oval, moderately convex. Clypeus broadly, shallowly emarginate; horn on vertex (Fig. 221) extending transversely between anterior margins of eye, basal third of horn broad, rising vertically, then abruptly angled (90°) inward on each side to narrow, nearly cylindrical continuation of horn; cylindrical two-thirds of horn slightly tapered to vaguely binodose or narrowly truncate apex; posterior basal portion of horn shining, at most finely punctate. Pronotum moderately declivous in anterior third, summit rounded; pronotum otherwise evenly convex; surface minutely punctate, appearing nearly smooth, shining; posterior marginal bead complete, the indentation containing a row of punctures. Elytral striae shallowly impressed, fine, seen as a double line only at high magnification; strial punctures vague, scarcely wider than stria; elytral intervals feebly convex, surface nearly smooth, shining. Metasternum laterally and adjacent to middle coxae with long setae; medially smooth, midline vaguely impressed.

FEMALE. Size and shape similar to male. Differing in the following major characters: horn on vertex small, low, conical, feebly bidentate; pronotum slightly tumid in anterior fourth behind head, midline posteriorly feebly impressed.

MATERIAL EXAMINED. PANAMA, 34 specimens from: CANAL ZONE - Ancon; Barro Colorado Island; Fort Kobbe. COCLE PROV. - El Valle; Rio Hato. PANAMA PROV. - Rio La Jagua. COLLECTION DATES: May, June, July, August, September, October.

OTHER COUNTRIES, 4 specimens from: COSTA RICA, COLOMBIA.

REMARKS. The only major variation noted is the reduction of the size and development of the horn on the vertex in small males. The minute punctures on the pronotum and fine elytral striae are quite constant and should serve to identify Panamanian specimens.

There is one very closely related species that occurs from Mexico to Costa Rica, D. centralis (Harold), and there is a strong likelihood that it may be taken in western Panama. It differs from agenor in the following characters: posterior base of horn rugose in males, pronotum moderately and closely punctate, elytral striae wide, strial punctures contiguous and making sides of striae appear crenulate.

Both species are attracted to carrion and dung. The usual habitat of agenor is lowland pastures and clearings.

5. Dichotomius inachus (Erichson) New Combination

Fig. 222

Pinotus inachus Erichson, 1847, p. 108.

Type, Berlin (?). Not seen.

MALE. Length 11 to 13 mm, greatest width 7 to 8 mm. Black, largely shining, shape oblong-oval, not strongly convex. Clypeus feebly to moderately rugose-punctate. Frontal tubercle (Fig. 222) conical, feebly indented apically. Vertex finely punctate. Pronotum evenly convex, minutely punctate laterally, smooth otherwise. Elytral striae moderately impressed, each stria delimited by narrowly separated double line, lines broken by very shallow, poorly delimited punctures. Pygidium smooth, marginal bead not broken. Metasternum setose between middle coxae, sparsely so laterally, lateral portions with scattered punctures separated by two or more diameters. Middle femur with three to five setigerous punctures on ventral apical surface.

FEMALE. Similar in size and form to male, clypeus medially notched, frontal tubercle obsolete. Other differences minor.

MATERIAL EXAMINED. PANAMA, 1 male, 2 females from: COCLE PROV. - Rio Hato, 22.V.1960, V.J. Tipton, at light.

OTHER COUNTRIES, 25 specimens from: PERU, TRINIDAD.

REMARKS. The few differences in the Panamanian specimens have been included in the description. Specimens from South America vary more in size and the punctures on the metasternum are often larger and more numerous. There is a complex of species involved and the inachus group needs a thorough revision before names can be applied with certainty.

The relatively small size and smooth pronotum should distinguish inachus from other Dichotomius known to occur in Panama.

This species has been collected in Panama at light, and at human feces in Trinidad.

6. Dichotomius femoratus n. sp.

Figs. 223-226

HOLOTYPE. Male, length 14 mm, greatest width 8.4 mm. Head brownish black, pronotum and elytra black. Shape oblong-oval, moderately convex. Clypeus bidentate with V-shaped notch between teeth, clypeal surface punctate, less so medially. Vertex (Fig. 224) with low conical horn. Gena and posterior third of vertex with scattered coarse punctures. Pronotum with anterior third of pronotal convexity behind head feebly concave, summit rounded, tubercles lacking; midline of pronotum posterior to concavity impressed; entire surface of pronotum with scattered coarse punctures, very minute secondary punctures interspersed; posterior marginal bead represented by an irregular double row of ocellate punctures. Elytral striae impressed, each represented by a single line or nearly contiguous double line enlarged by small punctures separated by two to three diameters; on either side of each stria (in fresh, unworn, clean specimens) surface longitudinally finely shagreened, opaque, the opaque area occupying approximately one-fifth of width of interval; elytral intervals convex, centrally smooth and shining, occasionally with scattered minute punctures. Pygidium with marginal bead obsolete near apex, surface with scattered coarse punctures. Metasternum lacking setae, coarsely punctate laterally and along margins between middle coxae. Middle and hind femora nearly impunctate, 2 to 10 punctures present in apical thirds; femora each with posterior groove paralleling hind margin, groove becoming obsolete near trochanter. Abdominal sternites each with basal row of punctures extending across midline except obsolete on apical segment. Genitalia as in figs. 225, 226.

ALLOTYPE. Female, length 14.5 mm, greatest width 9 mm. Differing from male in following respects: clypeal surface (Fig. 223) moderately rugose, feebly so medially; vertex with low, poorly defined obtusely angulate swelling, median anterior angle of swelling anteriorly dissected, slightly more elevated and feebly binodose; pronotum evenly convex except for feebly impressed midline, more distinctly impressed posteriorly, pronotal surface coarsely punctate, vaguely ocellate punctures clustered along midline; abdomen with sixth (apical) sternite with feeble median swelling.

TYPE MATERIAL: Holotype, male, Panama, Canal Zone, Barro Colorado Island, 8.VI.1978, N.E. Woodley, in trap baited with Lepidoptera frass (Cambridge). Allotype, female, Panama (Panama Prov.), Cerro Campana, 3000 ft., 30.VII.1970, H. & A. Howden (Howden).

PARATYPES, 3 females: 1, same data as allotype; 2, same locality as holotype, 13.VIII.1978, H. Hespenheide, 20.VI.1979, T.C. Poulson.

Paratypes are in: Howden, Poulson.

REMARKS. The female paratypes measure 13.0 to 13.5 mm in length and 8.5 mm in greatest width. In one paratype all sternites except the basal one have an extremely feeble swelling or irregularity at the midline. Otherwise the paratypes closely resemble the allotype.

The species should probably be placed near the *globulus* complex, but the largely impunctate middle and hind femora with the distinctive posterior groove separates it from this group. The coarsely punctate pronotum and very fine elytral striae and small strial punctures are also quite distinctive. The unusual opaque area on either side of the elytral striae, which is only evident in fresh, clean specimens, is seemingly a unique character, and distinguishes *femoratus* from related species in Costa Rica and Colombia.

The two female specimens from Cerro Campana were collected on human feces.

7. *Dichotomius* *gamboaensis* n. sp.

Figs. 227-229

HOLOTYPE. Male, length 11.5 mm, greatest width 6 mm. Black, relatively dull; shape oblong-oval, not strongly convex. Clypeus bidentate, V-shaped notch between moderately reflexed teeth; clypeus feebly rugose laterally, coarsely punctate elsewhere except near midline. Frons (Fig. 227) with low, rounded tubercle. Vertex moderately, closely punctate in anterior half, nearly impunctate posteriorly. Pronotum evenly convex, lacking carina or swellings, surface closely punctate, punctures of two types, moderate sized and ocellate with interspersed minute punctures; posterior marginal bead represented by irregular double row of coarse punctures. Elytral striae moderately impressed, each stria with feeble double line broken by single row of small punctures; elytral intervals moderately convex, dull, with scattered, minute shiny spots. Pygidium with complete marginal bead (line), moderately punctate, more closely so basally. Metasternum lacking setae, moderately, densely punctate except along midline. Middle and hind femora with distinct groove paralleling posterior edge; middle femur punctate in apical third, hind femur punctate in apical two fifths. Basal five abdominal sternites with basal row of punctures extending across midline. Genitalia as in figs. 228, 229; dorsal lateral edges of parameres finely serrate.

ALLOTYPE. Female, length 12.5 mm, greatest width 7 mm. Differing from holotype in the following major characters: clypeus more abruptly notched between teeth; elytral striae feebly impressed, intervals feebly convex; hind femur closely punctate in apical half, scattered punctures elsewhere.

TYPE MATERIAL: Holotype, male, Panama, Canal Zone, Gamboa, Limbo Hunt Club, 23-24.X.1975, O.P. Young, tapir feces trap (Washington). Allotype, female, Panama, Canal Zone, Gamboa, 23-24.X.1975, O.P. Young, human feces trap (Washington).

PARATYPES: 3 males, 5 females; 4, same data as holotype; 3, same data as holotype except collected 28.IV.1975; 1, Panama, Canal Zone, 5 mi. NW Gamboa, 9°09'N, 79°49'W, 29.IX.1969, H.A. Hespenheide.

Paratypes are in: Ottawa, Washington, Howden.

REMARKS. The smallest specimen measures 11 mm, the largest 13 mm. Several females have the tubercle on the vertex feebly indented. Otherwise the series is relatively uniform.

Dichotomius gamboaensis is seemingly closely related to *D. globulus* (Felsche). It differs from this species in having the punctures in the elytral striae and of the pygidium less pronounced, the punctures on the middle and hind femora smaller and more apically concentrated, and the genitalia wider apically and with the apices of the parameres bent downward.

Copris Müller

Copris Müller, 1764, p. 11; Matthews, 1961, p. 35.

Type-species: *Scarabaeus lunaris* Linnaeus, by subsequent designation, Curtis, 1832.

Usually black, size moderate (12 to 24 mm); scutellum not visible; elytron with nine striae (10 counting inflexed margin); mesosternum short, transverse, with median area impunctate; meso-metasternal suture obtusely angulate; mesosternum between middle coxae parallel-sided, lacking setae; abdomen with six distinct sternites, at least basal five not greatly narrowed medially, distinct at midline; hind tibia gradually expanded to apex, with distinct transverse carina near middle on outer surface; all tarsi with claws.

Key to species of *Copris* (after Matthews, 1961)

MAJOR MALES

1. Median pronotal prominences, when present, transversely truncated; lateral pronotal carina absent; lateral pronotal margin evenly curved . . 2

Median pronotal prominences rounded or acute; lateral pronotal carina present; lateral pronotal margin sinuate or slightly angulate near anterior third 3

2. Head horn arising approximately from middle of head surface; tubercle behind it erect or sometimes bent (never inclined) forward; dorsal edges of median pronotal prominences, when seen from the front, sloping down laterally at an angle of about 45° from horizontal; size 14-18 mm . . . . 1. *lugubris* Boh.

Head horn arising from before middle of head; tubercle behind horn inclined forward; dorsal edges of median pronotal prominences, when seen from the front, almost horizontal; size 14-19 mm . . . . 2. *incertus* Say

3. Anterolateral angle of pronotum with point made salient by an inward curve or emargination of the margin immediately behind; eighth elytral stria nearly always complete; inner border of pygidial margin incomplete; size 12-16 mm . . . . 3. *costaricensis* Gahan

Anterolateral angle of pronotum subquadrate, obtusely angled, or broadly rounded, occasionally acute in strongly developed specimens, never with a sharp inward curve of the margin immediately behind; eighth elytral stria incomplete, disintegrating posteriorly or largely effaced; pygidial margin complete or obsolete apically; size 17-24 mm . . . 4. *subpunctatus* Gill.

FEMALES

1. Lateral pronotal carina absent; lateral pronotal margin evenly curved; pygidial margin incomplete, the inner border effaced ventrally 2

Lateral pronotal carina present; lateral pronotal margin sinuate or slightly angulate; pygidial margin complete or not 3

2. Anterior portion of pronotum with surface before and behind transverse swelling distinctly punctate; punctate midline usually absent in anterior third; size 15-19 mm . . . . . 1. *lugubris* Boh.

Anterior portion of pronotum on and anterior to transverse swelling at most finely punctate; punctate midline usually extending almost to transverse swelling; size 14-18 mm. . 2. *incertus* Say

3. Anterolateral angle of pronotum with point made salient by an inward curve or indentation of lateral margin immediately behind (sometimes indistinct), margin often sharply sinuate anteriorly; eighth elytral stria nearly always complete; inner border of pygidial margin incomplete; size 13-15.5 mm. . 3. *costaricensis* Gahan

Anterolateral angle of pronotum subquadrate, obtusely angled, or broadly rounded, never with sharp inward curve or margin immediately behind; eighth elytral stria incomplete, disintegrating posteriorly; pygidial margin complete or obsolete apically; size 22-25 mm . . . . 4. *subpunctatus* Gill.

1. *Copris lugubris* Boheman

Fig. 230

Copris lugubris Boheman, 1858, p. 42; Matthews, 1961, p. 49.

Type, Stockholm. Not seen.

Length 14 to 18 mm. Well-developed males (Fig. 230) with slightly posteriorly directed arcuate horn arising from middle of head; immediately behind an erect or anteriorly bent tubercle (Fig. 230), the tubercle never inclined forward (see *incertus*). Male median pronotal prominences approximate, broadly, transversely truncate. Anterior pronotal angles obtuse in both sexes. Female head with short transverse carina or with narrow transverse horn posteriorly excavated. Pronotum with two low rounded prominences. For complete description see Matthews, 1961.

MATERIAL EXAMINED. PANAMA, 134 specimens from: CANAL ZONE - Barro Colorado Island; Coco Solo; Fort Kobbe; Madden Dam; Paraiso; Pipeline Road. CHIRIQUI PROV. - David; Hartmann's Finca, 1300 m; Potrerillos; Volcan de Chiriqui. COCLE PROV. - Anton; El Valle. PANAMA PROV. - Cerro Campana; La Chorrera; Maje; Rio La Jagua; Rio Las Lajas. VERAGUAS PROV. - San Pedro. COLLECTION DATES: Every month of the year.

OTHER COUNTRIES, 202 specimens from: MEXICO, BELIZE, GUATEMALA, EL SALVADOR, HONDURAS, NICARAGUA, COSTA RICA.

REMARKS. This species has been collected at light, and on cow, horse, human, and tapir feces. On Barro Colorado Island *lugubris* is active at night, particularly during the period 2100 to 0400 hours. It is present throughout the year with no significant peaks of abundance. The species occurs in forested areas at low and middle elevations.

2. Copris incertus Say

Fig. 231

Copris incertus Say, 1835, p. 175; Matthews, 1961, p. 44.
Type, Cambridge. Examined.
Copris procidua Say, 1835, p. 176; Matthews, 1961, p. 44.
Type, Cambridge. Examined.

Length 14 to 19 mm. Well-developed males (Fig. 231) with slightly curved, tapering clypeal horn situated anterior to middle of head; immediately behind an acute tubercle (Fig. 231) strongly inclined anteriorly, almost recumbent. Pronotum with median pronotal prominences low, transversely truncate anteriorly, approximate (never as well developed as in male major lugubris). Anterior pronotal angles obtuse in both sexes. Head of female usually with narrow, transverse, truncate horn apically excavated. For complete description see Matthews, 1961.

MATERIAL EXAMINED. PANAMA, 23 specimens from: BOCAS DEL TORO PROV. - Rio Changuinola. CANAL ZONE - Barro Colorado Island. CHIRIQUI PROV. - Alanje; Hartmann's Finca, 1300 m. COCLE PROV. - El Valle. COLON PROV. - Santa Rita Ridge. PANAMA PROV. - Cerro Campana; Maje. COLLECTION DATES: January, February, March, May, June, July, August, September, December.

OTHER COUNTRIES, 17 specimens from: MEXICO, BELIZE, EL SALVADOR, COSTA RICA, COLOMBIA.

REMARKS. This species has been captured at light, and on cow, horse, human, and tapir feces.

3. Copris costaricensis Gahan

Fig. 232

Copris costaricensis Gahan, 1894, p. 116; Matthews, 1961, p. 95.
Type, London. Not seen.
Copris furcillatus Felsche, 1910, p. 345; Matthews, 1961, p. 95.
Type, Dresden. Not seen.

Length 12 to 16 mm. Male majors (Fig. 232) with long, slightly bent, tapering head horn; median pronotal prominences merging into single bifurcate process. Both sexes with anterior pronotal angles acute, adjacent margin often sharply indented; pygidium with margin (bead) incomplete, inner border effaced ventrally. For complete description see Matthews, 1961.

MATERIAL EXAMINED. PANAMA, (records from Matthews, 1961): CHIRIQUI PROV. - Potrerillos; Volcan de Chiriqui, 2500-4000 ft., 6-8 June, 1882.

OTHER COUNTRIES, 2 specimens from: COSTA RICA.

REMARKS. The species had been taken on carrion, cow dung, and at light.

4. *Copris subpunctatus* Gillet

Fig. 233

Copris aspericollis var. *subpunctatus* Gillet, 1910, p. 3.
Type, Brussels. Not seen.
Copris subpunctatus Gillet; Matthews, 1961, p. 82.

Length 17 to 25 mm. Male majors (Fig. 233) with head horn massive and sharply bent at middle; pronotum humped behind median pronotal prominence, prominence divergent in dorsal view. Anterior pronotal angles acute in large specimens, rounded in small ones. Pygidium of males sometimes with margin broken near apex; margin always complete, unbroken, in females. For complete description see Matthews, 1961.

MATERIAL EXAMINED. PANAMA, (records from Matthews): CHIRIQUI PROV. - Chiriqui.

OTHER COUNTRIES, 5 specimens from: COSTA RICA.

REMARKS. According to Matthews (1961) all specimens with data were taken from October to June at light.

Phanaeus Macleay

Phanaeus Macleay, 1819, p. 124; Edmonds, 1972, p. 826 (synonomy and species groups).

Type-species: *Phanaeus vindex* Macleay, by subsequent designation, Edmonds, 1972.

Panamanian members of the genus may be recognized by the following combination of characters: clypeus usually with two obtuse teeth separated by single median indentation; head of males with posteriorly curved, nearly cylindrical horn; pronotum with anterior marginal bead interrupted behind eye; pronotum of males flattened, posterior angles often produced, flattened area of pronotum triangular in shape; both sexes frequently brightly colored (green to reddish purple), dorsum rarely entirely black.

Key to species of *Phanaeus*

1. Elytral striae with large, distinctly separated shallow punctures; color often cupreous to reddish purple . . . . 1. *hermes* Har.
Elytral striae lacking large, distinct punctures; color greenish or with cupreous pronotum and black elytra 2

2. Pronotum except in median posterior half or less distinctly granulate or rugose; dorsally uniform green or blue . . . . 2. *beltianus* Bates
Pronotum mostly smooth, sometimes finely granulate, punctate or feebly rugose laterally; head, pronotum and pygidium often cupreous or reddish green, elytra black . . . 3. *pyrois* Bates

1. Phanaeus hermes Harold

Fig. 234

Phanaeus hermes Harold, 1868, p. 83.

Cotypes, Paris. Not seen.

MALE. Length 13 to 18 mm, greatest width 9 to 11 mm. Dorsally green to cupreous, sometimes reddish to purple. Well-developed males with long, posteriorly curved horn on head. Pronotum with flattened area anteriorly with small tubercle on each side behind eye, posterior angles produced upwards and with outer margins incurved; pronotal surface distinctly granulate; posteriorly near margin with distinct fovea on either side of midline. Elytral stria (Fig. 234) with distinctive large punctures, giving elytra slightly wrinkled appearance, intervals feebly convex, dull.

FEMALE. Length 12 to 19 mm, greatest width 8 to 12 mm. Differing from male in the following major characters: head with low, anteriorly arcuate carina extending across frontal area, carina terminating on each side just anterior to eye; pronotum anteriorly with small, arcuate, tumid carina, the carina thickened at midline and often with small concavity behind; surface irregularly granulate-rugose, becoming punctate on disc in posterior fourth.

MATERIAL EXAMINED. PANAMA, 21 specimens from: CANAL ZONE - Ancon; Chiva Chiva; Empire. CHIRIQUI PROV. - Bugaba, 800-1500 ft.; David. PANAMA PROV. - Cerro Campana; Las Cumbres. COLLECTION DATES: May, June, July, August, September, December.

OTHER COUNTRIES, 3 specimens from: COSTA RICA, COLOMBIA.

REMARKS. Size is unusually variable, particularly when one considers the short series seen. Small males may have the head horn reduced to an arcuate carina and the pronotum almost evenly convex. Small females may have the pronotal carina and concavity obsolete. Size also influences the size of the pronotal granulations, but the characteristic large punctures in the elytral striae are quite consistent and serve to distinguish hermes from related species occurring in Panama.

The few specimens bearing accurate dates have been collected at human feces. Phanaeus hermes is diurnally active and occurs only in the wet season. The species is found in mid-elevation moist forests.

2. Phanaeus beltianus Bates

Figs. 235, 236

Phanaeus beltianus Bates, 1887, p. 63.

Cotypes, London and Paris. London specimens examined.

MALE. Length 15 to 18 mm, greatest width 10 mm. Color green with cupreous reflections on pronotum. Head with long, cylindrical, posteriorly curved horn. Pronotum (Fig. 235) with flattened central area delimited anteriorly by conical tubercle on either side about 1 mm behind margin posterior to inner edge of eye; posterior portion of flattened area delimited laterally by inwardly arcuate ridge terminating abruptly on each side in an acute point anterior to fourth elytral stria; surface of flattened area laterally and in anterior half transversely rugose, posterior central half with nearly smooth triangular area bounded posteriorly on each side by inner termination of arcuate ridge, narrowing anteriorly to small tubercle at midline near transverse median half of pronotum; lateral declivous sides of pronotum finely punctate; fovea on each side of posterior midline absent. Elytral striae largely impunctate, anteriorly terminating in distinct indentation; intervals feebly convex, smooth, moderately shining. Pygidium finely punctate. Genitalia as in fig. 236.

FEMALE. Length 14 to 18 mm, greatest width 10 to 11 mm. Differing from male in the following major characters: color dorsally greenish blue to blue; vertex with straight transverse carina, the carina trituberculate; pronotum convex except concave immediately posterior to short transverse arcuate or obtusely angled carina behind head, posterior margin of concavity sinuately tumid; surface of pronotum finely rugose, becoming finely punctate in median posterior fifth.

MATERIAL EXAMINED. PANAMA, 18 specimens from: CANAL ZONE - Barro Colorado Island; Chivos; Gamboa; Madden Forest; Pipeline Road. PANAMA PROV. - 8 km SE Bayano Bridge, 9°10'N, 78°46'W. COLLECTION DATES: May, June, July, September, October, November, December.

OTHER COUNTRIES, 7 specimens from: BELIZE, NICARAGUA, COSTA RICA.

REMARKS. The above description was based only on Panamanian specimens, which differ slightly from those from Belize and Nicaragua. Typical beltianus (from Nicaragua) are often more olive green, the male pronotum more strongly rugose, the small anterior conical tubercles slightly more widely spaced and the smooth pronotal area smaller and rhomboid in shape. Generally the Panamanian specimens differ from typical beltianus in approximately the same degree as beltianus differs from sallei. As Edmonds (1972) has stated, the entire complex needs further study.

This species has been taken in bat mist nets, and at howler monkey, human, spider monkey, and tapir feces.

On Barro Colorado Island, beltianus is diurnally active, restricted as adults to the wet season, and more common in level areas than in ravines. The species is limited in central Panama to lowland moist forests.

3. Phanaeus pyrois Bates

Fig. 237

Phanaeus pyrois Bates, 1887, p. 58; Olsoufieff, 1924, p. 92.

Cotypes, London and Paris. London specimens examined.

MALE. Length 14 to 16 mm, greatest width 9 to 11 mm. Head, pronotum and pygidium largely cupreous or greenish cupreous; elytra dull black. Head of well-developed males with long, cylindrical, posteriorly curved horn. Pronotum (Fig. 237) with flattened triangular portion smooth, often finely punctate or granulate laterally, posterior angles produced laterally, not noticeably elevated; pronotal fovea on either side of midline adjacent to posterior margin small to obsolete. Elytral intervals feebly convex, dull. Pygidium finely, closely punctate, less so apically.

FEMALE. Length 16 to 17 mm, greatest width 10 mm. Differing from male in the following major characters: cupreous reflections present largely on posterior portion of head and lateral third of pronotum; frontal area of head with low, slightly arcuate, feebly trituberculate carina; pronotum largely convex, three small tubercles present in transverse line at anterior fourth of pronotum behind head; pronotal surface smooth to finely punctate laterally.

MATERIAL EXAMINED. PANAMA, 90 specimens from: CANAL ZONE - Barro Colorado Island, Frijoles, Madden Forest, Pipeline Road. COLON PROV. - Santa Rita Ridge. PANAMA PROV. - Cerro Campana, 3000 m; Maje. COLLECTION DATES: January, February, March, May, June, July, August, September, October, November, December.

OTHER COUNTRIES, 20 specimens from: NICARAGUA, COSTA RICA, COLOMBIA.

REMARKS. Small males, as can be expected, may have the horn on the head greatly reduced in length and the triangular, flattened area reduced in size. The cupreous color of the head and pronotum may also be mostly lacking. A totally black form, *P. funereus* Balth., is a very closely allied species or variety occurring in Ecuador.

This species has been obtained from rotting fruit of *Gustavia* sp.; from agouti, lizard, mouse, rat, and tamandua carrion; and from coati, howler monkey, human, and spider monkey feces. On Barro Colorado Island *pyrois* is active diurnally and is most abundant in the late wet season.

Sulcophanaeus Olsoufieff

Sulcophanaeus Olsoufieff, 1924, p. 23; Edmonds, 1972, p. 821.

Type-species: *Scarabaeus sulcatus* Drury (= *carnifex* L.), by original designation.

The genus as defined by Edmonds (1972) is composed of three species groups, only one of which, the *auricollis* group, occurs in Panama. The three Panamanian species in the group may be recognized by the following combination of characters: clypeus shallowly emarginate medially, at most feebly bidentate; anterior lateral pronotal margin between eye and lateral angle sinuate, marginal bead not broken behind eye; elytra dull black, intervals very slightly convex; male majors with long, recurved horn on head; females with distinctive sinuate V-shaped carina on pronotum behind head.

Key to species of *Sulcophanaeus*

1. Pygidium and legs largely black; pronotum of major males with a low, broad, obtuse projection posteriorly on either side of midline 2

Pygidium and legs largely cupreous to greenish red; pronotum of major males with a long, cylindrical anteriorly directed horn on either side of midline . . . . 1. velutinus (Murr.)

2. Pronotum black. . . . . 3. noctis (Bates)
Pronotum greenish to cupreous . 2. cupricollis (Nev.)

1. Sulcophanaeus velutinus (Murray)

Fig. 238

Phanaeus velutinus Murray, 1856, p. 213.
Type, London. Examined.
Sulcophanaeus velutinus (Murray); Edmonds, 1972, p. 821.

MALE. Length 16 to 20 mm, greatest width 8 to 11 mm. Black with margin of pronotum, femora, and pygidium often cupreous to green. Frontal area of head of well-developed males with long, nearly cylindrical horn, arcuately bent posteriorly near apex. Pronotum (Fig. 238) concave in anterior half behind head; a long, anteriorly directed cylindrical horn on each side of midline at summit of concavity; pronotal surface smooth to obsoletely punctate laterally; pronotal fovea near posterior midline vague to moderately developed. Elytral intervals nearly flat, frequently with transverse wrinkles.

FEMALE. Length 17 to 19 mm, greatest width 10 to 11 mm. Differing from males in the following major characters: frontal ridge vaguely carinate, feebly trituberculate; pronotal carina as described for genus; pronotal surface largely punctate, many punctures coalescing.

MATERIAL EXAMINED. PANAMA, 20 specimens from: CHIRIQUI PROV. - 2 km N Santa Clara (= 15 km W Hato del Volcan), 1300 m, Hartmann's Finca. COLLECTION DATES: May.

OTHER COUNTRIES, 2 specimens from: COSTA RICA (COLOMBIA and ECUADOR cited in literature).

REMARKS. Males vary allometrically, small specimens having both the head and pronotal horns greatly reduced. In other respects Panamanian specimens show little variation, the pygidium at least always showing some metallic (green or cupreous) reflections.

The species has been taken in nearly equal numbers at feces and carrion traps and seems to be primarily nocturnal.

2. Sulcophanaeus cupricollis (Nevinson) New Combination

Fig. 239

Phanaeus cupricollis Nevinson, 1891, p. 209.
Cotypes, London. Not seen.

MALE. Length 18 to 20 mm, greatest width 10 to 11 mm. Color largely black; clypeus and most of pronotum cupreous green, pygidium often faintly purple or violet. Frontal area of head with long, posteriorly curved horn. Pronotum (Fig. 239) with disc greatly flattened, the quadrate area bordered anteriorly on each side with slightly compressed acute tooth and posteriorly by an incurved broad ridge abruptly elevated on either side of concave median area; concave area posteriorly with small, distinct fovea on each side of midline; lateral areas of pronotum moderately rugose-punctate. Elytral intervals nearly flat, sparsely transversely wrinkled, dull. Pygidium distinctly punctate.

FEMALE. Length 19 mm, greatest width 11 mm. Differing from male in following major characters: frontal area tumid, vaguely cariniform, tubercles obsolete; pronotal carina as described for genus, abruptly rounded anteriorly; surface of pronotum rugose, feebly so posteriorly.

MATERIAL EXAMINED. PANAMA, 25 specimens from: BOCAS DEL TORO PROV. - Rio Changuinola. CANAL ZONE - Barro Colorado Island; Madden Forest. PANAMA PROV. - Cerro Azul; Cerro Campana. COLLECTION DATES: January, February, March, April, May, July, August, September, October, November, December.

OTHER COUNTRIES, 2 specimens from: NICARAGUA.

REMARKS. There are slight differences in the configuration of the pronotal ridge and undoubtedly small males (none seen) will have the horn and pronotal protuberances reduced. All specimens seen of both sexes have the pronotum largely cupreous green.

The species, *S. cupricollis*, has incorrectly been synonymized with *chryseicollis* Harold and by inference with *auricollis* Harold. Males of both of these latter species have the posterior pronotal concavity separating the posterior "horns" wider and the "horns" more acute and elevated than in *cupricollis*. In our opinion *noctis* is the species most closely related to *cupricollis*; see discussion under *noctis* for comparison.

This species has been found on agouti carrion, and at howler monkey, human, and tapir feces.

On Barro Colorado Island, *S. cupricollis* is active diurnally, particularly during the period of 0900 to 1200 hours. It occurs on Barro Colorado Island only during the late wet season and early dry season.

3. *Sulcophanaeus noctis* (Bates)

Fig. 240

Phanaeus noctis Bates, 1887, p. 56.

Cotypes, London and Paris. London specimens examined.

Sulcophanaeus noctis (Bates); Edmonds, 1972, p. 826.

MALE. Length 15 to 19 mm, greatest width 9 to 12 mm. Frequently entirely black, occasionally with traces of cupreous or green near posterior lateral pronotal margin. Horn on head, quadrately flattened pronotal disc (Fig. 240) and surrounding protrusions as described for *S. cupricollis*; pronotal surface laterally smooth to feebly wrinkled (obsoletely punctate). Elytral intervals nearly flat, dull. Pygidium not punctate or feebly so basally.

FEMALE. Length 15 to 20 mm, greatest width 8.5 to 11.5 mm. Very similar to other females in genus, particularly *cupricollis* from which it differs in lacking the metallic coloration of the pronotum and by having the pronotum only slightly rugose, more obviously punctate.

MATERIAL EXAMINED. PANAMA, 2 specimens from: CHIRIQUI PROV. - Bugaba; Volcan de Chiriqui (cotypes).

OTHER COUNTRIES, 50 specimens from: COLOMBIA, ECUADOR.

REMARKS. A series of 29 males collected in Ecuador shows extensive allometric growth. Small (15-16 mm) males have the horn on the head reduced to a low, straight, transverse carina; the pronotum in the same specimens is almost evenly convex, pronotal protrusions being reduced to three small tubercles forming a transverse row about 1 mm behind the anterior margin. One moderately developed male from Ecuador has the pronotum largely cupreous, approaching the coloration of *cupricollis*.

There is little doubt that *cupricollis* and *noctis* are extremely close and possibly *cupricollis* should be placed as a synonym of *noctis*. However in the series we have seen, the sides of the pronotum are always more distinctly rugose in *cupricollis*, the pygidium is more distinctly punctate, there is a slight difference in the position and shape of the pronotal horns or protrusions and usually *cupricollis* has a distinctly cupreous to green pronotum while *noctis* is mostly black; this color difference is particularly evident in the females. Because of these differences we have continued to treat the two forms as distinct species.

The Ecuadorian specimens were taken in almost equal numbers in dung and carrion traps set in lowland wet forest on the west side of the Andes.

Coprophanaeus Olsoufieff

Coprophanaeus Olsoufieff, 1924, p. 22; Edmonds, 1972, p. 843.

Type-species: *Scarabaeus jasius* Olivier, by original designation.

All Panamanian species are in the subgenus *Coprophanaeus* as established by Edmonds, 1972. Both the *jasius* and *dardanus* species groups are represented and may be recognized by the following combination of characters: mostly black species, occasionally with slight metallic green, purple, or cupreous reflections on the lateral pronotal margins; clypeal margin with two distinct acute teeth, sharply incised not only medially but laterally.

Key to species of *Coprophanaeus*

1. Elytral intervals, except at base, nearly flat to very feebly convex, uniformly dull; pronotum black or with greenish cast 2
Elytral intervals slightly to moderately convex, dull primarily near striae; pronotum often with bluish-purple cast . . . . 2. *chiriquensis* Ols.

2. Male with low, nearly vertical, transverse tri-tuberculate carina extending across anterior

edge of frons; female with similar carina, but tubercles close, often separated by approximately their own diameter or less; pronotal margins lacking metallic reflections . . . 3

Male with posteriorly inclined flattened carina, a small tubercle on each side medially with central tubercle usually developed into a short cylindrical horn; female with low transverse trituberculate carina, the tubercles separated by more than own diameter, the carina only slightly anterior to eyes; pronotum of both sexes frequently with metallic reflections . . . . 1. *telamon corythus* (Har.)

3. Well-developed males with shallow longitudinal depression on each side adjacent and anterior to transverse pronotal carina, the depression distinctly separated from lateral pronotal fovea; both sexes with excavate posterior edge of hind trochanter with scattered setae basally . . . . 3. *ohausi* (Fels.)

Well-developed males lacking distinct longitudinal depression on pronotum or with depression contiguous with lateral pronotal fovea; both sexes with excavate posterior edge of hind trochanter lacking setae . . . . . . 4. *pecki* n. sp.

1. *Coprophanaeus telamon corythus* (Har.)

Figs. 241-243

Phanaeus corythus Harold, 1863, p. 163.
Type or cotype, Paris. Not seen.
Phanaeus (*Coprophanaeus*) *corythus* Har.; Olsoufieff, 1924, p. 68.
Coprophanaeus telamon corythus Har.; Pereira and Martínez, 1956, p. 234.

MALE. Length 20 to 26 mm, greatest width 12.5 to 15.5 mm. Black, frequently with trace of greenish or cupreous reflections along anterior and lateral margins of pronotum. Clypeus (Fig. 241) with lobe on each side of acute teeth angulately truncate to obtuse angle. Horn on vertex anteriorly broadly flattened, sloping posteriorly, sides narrowing to small lateral denticle then narrowed to short, median, cylindrical, slightly anteriorly curved horn. Pronotum shallowly concave and shining below binodose swelling; area between nodes evenly, posteriorly arcuate when viewed from above; distance between nodes approximately equals distance between middle of each eye. Pronotal surface laterally rugose, finely punctate to smooth behind swelling, surface just anterior to posterior pronotal margin on each side of midline with small fovea. Elytral intervals uniformly dull, very feebly convex. Male genitalia as in figs. 242, 243.

FEMALE. Length 18 to 24 mm, greatest width 11 to 15 mm. Differing from male in following major characters: head with low trituberculate transverse carina at anterior edge of frons, carina laterally curving posteriorly on each side mesad of eye, terminating near posterior margin of eye; tubercles on carina separated by two to three times own width; pronotum with anteriorly arcuate carina approximately 1 mm behind anterior margin, the carina extending no more than width of eyes, usually slightly less; pronotum briefly concave behind carina, concavity and lateral surfaces uniformly rugose, pronotum becoming punctate on basal third.

MATERIAL EXAMINED. PANAMA, 34 specimens from: CANAL ZONE - Barro Colorado Island; Corozal; Frijoles; Gamboa; Madden Forest. COLON PROV. - 270 m, 16 km SE Colon, Santa Rita Ridge. DARIEN PROV. - Rio Tacarti, 1900 ft. COLLECTION DATES: February, April, May, June, July, September, October, November, December.

OTHER COUNTRIES, 32 specimens from: MEXICO, BELIZE, GUATEMALA, NICARAGUA, COSTA RICA (t. corythus), BRAZIL, COLOMBIA, PERU, VENEZUELA (t. telamon Er.).

REMARKS. Small males may have the head horn greatly reduced in height, forming a trituberculate carina, the middle tubercle being only moderately produced. There is also a similar reduction in the degree of pronotal swelling, but the shape and position is not drastically altered. Some specimens of both sexes may lack metallic reflections on the pronotum, this occurring most frequently in Mexican specimens.

The key characters and particularly the shape of the male head horn should identify telamon corythus. Specimens of the South American t. telamon Er. have the median lobe of the male horn abruptly posteriorly offset basally, then curved upward; in females the basal third of the pronotum is more heavily punctate.

In Panama specimens were attracted primarily to carrion with a few coming to dung. The species is most abundant in the late rainy season. Flight activity seems to be mostly nocturnal. Most specimens were taken in lowland forests below 1000 m.

2. Coprophanaeus chiriquensis Olsoufieff

Figs. 244-247

Phanaeus (Coprophanaeus) chiriquensis Olsoufieff, 1924, p. 73.

Type, Paris. Not seen.

MALE. Length 14 to 18 mm, greatest width 9 to 12 mm. Dorsally black, often with violet reflections on sides of pronotum and elytra. Clypeus (Fig. 244) with lobe on each side of acute teeth low, broadly arcuate to feebly angled, frontal carina trituberculate, lateral tubercle on each side often slightly larger than median one. Major males with broad median pronotal protuberance (Fig. 245) delimited laterally by longitudinal depression extending toward lateral edge of eye; anterior face of protuberance smooth, dorsal edge irregularly cariniform, edge thickened on either side of slight depression at midline. Pronotum posteriorly with small fovea on either side of midline just anterior to posterior margin. Elytral intervals slightly, but noticeably convex; each interval dull near striae, feebly shining medially. Genitalia as in figs. 246, 247.

FEMALE. Length 16 to 20 mm, greatest width 11 to 13 mm. Differing from male in the following major characters: frontal carina with three small tubercles, median one slightly elevated, tubercles separated by a distance approximately equal to three times width of tubercle; pronotum with transverse carina about 1 mm behind anterior margin, length of carina equal to or slightly exceeding outside width of eyes; carina with small, usually distinct tubercle or angle on either side of shallow, median indentation; area immediately behind carina shallowly concave, rugose, sometimes less so near carina; posterior third of pronotal disc nearly smooth, dull.

MATERIAL EXAMINED. PANAMA, 28 specimens from: CHIRIQUI PROV. - 15 km NW Hato del Volcan, 1500 m, Hartmann's Finca; 10 km W Cerro Pando. COLLECTION DATE: May.

OTHER COUNTRIES, One closely related species occurs in Mexico, another in Ecuador. We have not been able to assign names to these, the one in Ecuador being possibly *C. roubali* Balth.

REMARKS. In small males the pronotal protuberance is represented by a low carina, shallowly depressed medially. In small females the area immediately behind the transverse pronotal carina may be only feebly concave. The faint violet color may be limited to the sides of the pronotum in either sex.

This species has seemingly gone unrecognized since Olsoufieff's description based on three females from "Chiriqui". Morphologically, females of *chiriquensis* are very close to females of *telamon corythus* and have been incorrectly synonomized under that species. The faint violet color of *chiriquensis* should serve to separate it from *t. corythus* which has greenish or cupreous reflections (if any). Also the form of the male pronotum is very different from males of *t. corythus*, and the pronotal carina of female *chiriquensis* is more distinctly bidentate.

At present *chiriquensis* is known only from the vicinity of the Volcan de Chiriqui at elevations of approximately 1500 m. It has been taken in traps baited with human feces and with carrion, apparently favoring the latter.

3. *Coprophanaeus ohausi* (Felsche)

Figs. 248-250

Phanaeus ohausi Felsche, 1911, p. 138.

Type, Dresden (?). Not seen.

MALE. Length 22 to 26 mm, greatest width 12 to 14 mm. Black, lacking metallic reflections. Clypeal lobe on either side of acute teeth broadly, obtusely angulate. Transverse frontal carina as wide as distance between eyes, at least one eye diameter anterior to eyes; carina low, trituberculate, tubercles separated by approximately two times their diameter. Frons and most of vertex finely punctate. Crest of transverse pronotal carina in well-developed males (Fig. 248) with four swollen or thickened areas, one on each side of midline and one at each side at termination of carina; in smaller males only lateral thickening of carina evident, the carina slightly bowed medially. Lateral termination of carina delimited anteriorly by elongate depression extending anteriorly toward outer margin of eye, the elongate depression distinctly separate from lateral fovea; pronotal surface moderately rugose laterally, smooth to obsoletely punctate elsewhere; distinct posterior depressions near pronotal margin absent or very feebly indicated. Elytral striae nearly flat, dull. Excavated posterior edge of hind trochanter with setae. Genitalia as in figs. 249, 250.

FEMALE. Length 20 to 23 mm, greatest width 11.5 to 13 mm. Differing from male in the following major characters: frontal carina low, feeble, tubercles large, well-developed, separated by approximately one diameter; transverse pronotal carina broadly obtuse, blunt at anterior median edge, vaguely indented in some specimens; surface behind carina shallowly concave, surface rugose to rounded summit; laterally posterior third of pronotal disc mostly smooth.

MATERIAL EXAMINED. PANAMA, 13 specimens from: BOCAS DEL TORO PROV. - Rio Changena, 2400 ft. CANAL ZONE - Madden Forest. COLON PROV. - 16 km SE Colon, 270 m, Santa Rita Ridge. PANAMA PROV. - Cerro Campana, 800 m. COLLECTION DATES: May, September.

OTHER COUNTRIES, 5 specimens from: ECUADOR.

REMARKS. The transverse pronotal carina in the males varies considerably both in local populations and geographically. Males from Ecuador have the carina laterally produced, sometimes extending slightly over the oblong lateral concavity. In other males, particularly Panamanian specimens, the carina may be nearly straight medially and lack median swellings; in some the thickening of the carina on either side may be anterior in position to the lateral thickenings or angles, giving the carina an irregular arcuate shape. Other characters, including the genitalia, show little variation. Males from Ecuador can often be distinguished from those from Panama, but the differences do not seem sufficient to warrant nomenclatorial recognition of the geographic variation.

The characters given in the key, the lack of metallic reflections and the shape of the pronotal carina should serve to distinguish the species from related forms occurring in Panama.

The species has been taken in traps baited with human feces and carrion, seemingly preferring the latter.

4. *Coprophanaeus* *pecki*, n. sp.

Figs. 251-253

HOLOTYPE. Male, length 26 mm, greatest width 14.5 mm. Dorsally dull black, lacking any metallic reflections. Clypeus (Fig. 251) with lobe on either side of the two acute teeth obtusely angulate; clypeal surface anterior to frontal carina transversely rugose. Transverse frontal carina abruptly vertical, slightly over two eye diameters anterior to anterior margins of eyes, transverse width of carina less than distance between eyes; carina trituberculate, median tubercle slightly elevated above lateral ones; surface of frons and vertex posterior to carina smooth. Pronotum at anterior third with bilobed transverse carina extending slightly more than distance between outside of eyes, the carina most prominent on either side of midline, curved anteriorly laterally. Pronotal surfaces laterally moderately rugose, smooth before and behind carina; surface on either side of midline just anterior to posterior margin feebly depressed. Elytral intervals nearly flat, smooth, dull. Pygidium feebly, finely punctate. Fore tibia quadridentate on outer margin. Excavated posterior edge of hind trochanter lacking setae. Metasternum nearly flat, smooth, very finely punctate, midline vaguely impressed. Genitalia as in figs. 252, 253.

ALLOTYPE. Female, length 28 mm, greatest width 17 mm. Differing from male in the following major characters: tubercles of frontal carina distinctly closer, median tubercle slightly more pronounced than lateral ones, width of carina distinctly reduced; surface behind carina finely punctate except in posterior third of vertex; transverse pronotal carina obtusely angled, the anterior median angle abruptly emarginate at midline, bidentate; carina medially about 0.8 mm behind posterior edge of marginal bead; surface immediately posterior to carina concave, moderately rugose; surface of pronotum behind concavity rugose, punctate to finely so laterally and medially, nearly impunctate centrally in posterior fourth; indentation on either side of midline near posterior margin obsolete.

TYPE MATERIAL: Holotype, male, Panama, Chiriqui Prov., 15 km NW Hato del Volcan, 1200 m, Hartmann's Finca, 20-31.V.1977, S. Peck, in dung trap (Howden). Allotype, female, same data as holotype (Howden).

PARATYPES: 8 males, 11 females. PANAMA: 2 females, same data as holotype; 3 males, 4 females, Chiriqui Prov., 10 km W Cerro Pando, 24.V.1977, S. Peck, carrion trap. COSTA RICA: 1 female, Puntarenas Prov., 15 km NE Potrero Grande, Finca Helechales, 1.IX.1967, R.W. McDiarmid; 1 male, 2 females, Puntarenas Prov., 6 km S San Vito, 08°42'N, 83°00'W, 25-28.IV. 1967, D.F. Veirs; 4 males, 2 females, Puntarenas Prov., 6 km S San Vito, 1000 m, 27.IV-7.V.1967, D.F. Veirs, in forest in traps - meat and human feces.

Paratypes are in: Ottawa, Washington, Edmonds, Howden.

REMARKS. Body length in the specimens seen ranges from 22 to 28 mm. The three male paratypes from Panama have the carina on the frons slightly narrower than in the holotype and in one male with the most reduced carina the median tubercle is distinctly elevated. The greatest variation in the males occurs in the pronotal carina which is binodose in large males, nearly truncate and lacking any lateral concavity in smaller males. The same type of variation may be found in females. Large specimens have three distinct tubercles on the frontal carina and the pronotum is distinctly tumid on either side of the midline; small females may have the frontal carina arched with tubercles obsolete, and the pronotum may be only very feebly tumid on either side behind the concave area.

Small specimens of either sex may be confused with the related *C. ohausi*, but *ohausi* has at least a few setae on the posterior excavated edge of the hind trochanter. These setae are lacking in *pecki*.

The species is named for Dr. Stewart Peck who collected all of the Panamanian series.

Oxysternon Laporte (= Castelnau)

Oxysternon Laporte, 1840, p. 82; Edmonds, 1972, p. 838.

Type-species: *Scarabaeus festivus* Linnaeus, by subsequent designation, Martínez and Pereira, 1967.

Edmonds, 1972, divided *Oxysternon* into two subgenera. Only two species of the nominate subgenus are known to occur in Panama. Both of these are largely greenish, broadly oval species that can be distinguished from the related genus *Phanaeus* by the following characters: metasternum with anterior median projection forming a long, sharp spine that terminates anteriorly between the anterior coxae; posterior margin of pronotum medially extended posteriorly, forming an acute angle.

Key to species of *Oxysternon*

1. Length 18 to 25 mm; male with conical or cylindrical horn on head; both sexes with anterior pronotal margin thickened adjacent to anterior angles . . . . 1. *conspicillatum* (Web.)

Length 12 to 15 mm, male with low, transverse tuberculate carina on head, both sexes with anterior pronotal margin not noticeably thickened adjacent to anterior angles . . . 2. *zikani* Per.

1. *Oxysternon conspicillatum* (Weber)

Figs. 254-256

Copris conspicillatum Weber, 1801, p. 36.

Type, Kiel (?). Not seen.

Oxysternon conspicillatum (Weber); Olsoufieff, 1924, p. 113.

MALE. Length 19 to 25 mm, greatest width 12 to 17 mm. Dorsally green, usually with black pronotal markings. Well-developed males (Fig. 254) with long, cylindrical posteriorly curved horn on head. Pronotum on each side in lateral third with inwardly curved, longitudinally flattened horn, a transverse depression present between horns; pronotal surface smooth. Elytral intervals distinctly convex. Genitalia as in figs. 255, 256.

FEMALE. Length 19 to 23 mm, greatest width 12 to 16 mm. Differing from male in the following major characters: head with low transverse carina on frons; pronotum irregularly convex, a shallow longitudinal depression in anterior third on either side of midline; a feeble, arcuate or obtusely angled carina extending between pronotal depressions.

MATERIAL EXAMINED. PANAMA, 2 specimens from: DARIEN PROV. - Rio Tacarti, 1900 ft. COLLECTION DATE: July.

OTHER COUNTRIES, 50 specimens from: COLOMBIA, VENEZUELA, ECUADOR, BRAZIL, BOLIVIA, PERU.

REMARKS. There is considerable variation in size. Very small males resemble females. Also the configuration and extent of the black markings on the pronotum is extremely variable.

The species is easily recognized by its large size, basic green color, convex elytral striae, and the characters mentioned for the genus. In Colombia the species is commonly found flying during the day in open or second growth areas where it is readily attracted to human feces. It can also be found at cow and horse dung, and occasionally at carrion.

2. Oxysternon zikani Pereira

Figs. 257-259

Oxysternon zikani Pereira, 1943, p. 109.

Type, Pereira collection (?). Not seen.

MALE (Panama and Ecuador). Length 15 to 17 mm, greatest width 10 mm. Dorsally green with black markings in central area of pronotal disc and on elytral umbone. Clypeus feebly emarginate medially, beneath emargination lacking spiniform process. Frontal area of head (Fig. 257) with transverse, binodose ridge. Pronotum in anterior half with low longitudinal, rounded ridge on either side of midline, concave between and shallowly so on outside of ridges; posterior half of pronotum convex, smooth. Elytral striae moderately indented, not distinctly punctate, intervals moderately convex. Pygidium feebly punctate. Fore tibia with four teeth on outer margin. Genitalia as in figs. 258, 259.

FEMALE (Panama specimens). Length 14 to 16 mm, greatest width 9 to 10 mm. Differing from male in the following major characters: transverse frontal ridge trituberculate; longitudinal pronotal ridges lower, more broadly rounded, concavity between narrow.

MATERIAL EXAMINED. PANAMA, 4 specimens from: CANAL ZONE - Barro Colorado Island, Madden Forest. PANAMA PROV. - Maje. COLLECTION DATES: January, February, September.

OTHER COUNTRIES, 11 specimens from: COLOMBIA, ECUADOR, BRAZIL, PERU.

REMARKS. As pointed out by Edmonds (1972) there is some confusion in the silenus group of species. Olsoufieff (1924) implies that the males of silenus and related species have horns on the head. However there is at least one species where the male has a binodose transverse carina on the head and the pronotum is similar to that of the female. Since we have not seen the type of silenus that is supposedly a horned male, and since females of all species are similar, we do not believe the name can be applied to Panamanian specimens. In 1943 Pereira (p. 109) described O. zikani from Brazil and Peru and this seems to be the correct name to apply to the species lacking horns in the males. Unfortunately confusion concerning the application of the various names will remain until the silenus complex is revised. The smaller size is usually sufficient to separate zikani from the larger conspicillatum which also occurs in Panama.

Specimens of zikani have been taken on rodent fecal pellets, monkey dung and human feces.

TOPOGRAPHIC FEATURES AND FAUNAL PATTERNS

Panama, a country of approximately 47,600 sq km, has a rich and varied biota. Topography, geographic position, and at least its Tertiary history are factors that have contributed to its biotic diversity.

Panama lies between 7° and 10°N latitude and 77° and 83° 30'W longitude, the long axis of the country running approximately east-west (Fig. 260). The north or Caribbean side has, in general, a high rainfall and contains extensive areas of lowland, evergreen, tropical rain forest. Extending most of the length of the country lies an irregular spine of volcanic peaks and hills. The highest elevation, 3427 m, is in the west on the Volcan de Chiriqui (or El Baru), the lowest point in the divide, 65 m, in the Canal Zone. In the eastern province of Darien near the north shore a series of basaltic ridges attain elevations ranging between 1000 and 1800 m with a low point of 110 m in the "divide" (Haffer, 1970). About 85% of the land area is lower than 1000 m.

The north facing slopes of most of the ridges above about 800 m interrupt the cloud-trade wind pattern of the Caribbean. As a result of this many north facing slopes are moist throughout the year and have a rainfall often in excess of 3000 mm per year. In areas where the elevation ranges between 1000 m and 2500 m, a cloud forest type of formation may develop. Above 3000 m (mainly on Volcan de Chiriqui) an elfin type of forest mixed with open treeless areas exists. The south-facing slopes of the various sierras are usually well forested but with a fairly pronounced dry season extending, on the average, from January to April. Below 800 m and on the south coast the dry season is pronounced and large lowland areas are covered with a deciduous lowland forest formation (Fig. 261). The various forest zones and some of the more conspicuous species of these zones are discussed and listed by Porter (1973).

While the location, topography, and climate undoubtedly allow and contribute to the present diversity of the fauna, the historical relationship of the Panamanian fauna is a particularly interesting one. The distribution patterns of the 113 Panamanian species of Scarabaeinae that we recognize are placed into five categories in Table 2. Of these species, 42 are widespread, 13 occur in Panama and South America, 22 are found in Panama and Central America, 18 are restricted to Panama and Costa Rica, and 18 are limited to Panama. If one assumes that both the widespread and Panama-South American groups have a probable Pliocene-Pleistocene South American origin, then 48% (55 of 113) of the species show this affinity. On the other hand 58 species or 52% represent a Central American element with nearly 16% of the 113 species being restricted to Panama. The strong endemic nature of the Central American fauna has been discussed by Duellman (1966) for the herpetofauna, and Howden (1969) has discussed the variation in generic endemicity found in American Scarabaeidae as it might relate to Pleistocene climatic disturbances. If one considers the species endemicity occurring in Panama (18) plus that of western Panama — eastern Costa Rica (18), the 36 endemic species seem to concentrate in one of several of the areas of Panama that have been emergent for at least several million years; i.e., some of the oldest portions of Panama.

Because of this pattern, a brief mention of the geological history of Panama seems pertinent. The early history of the Caribbean area and the plate movements associated with continental drift have perhaps best been summarized by Malfait and Dinkleman (1972). In this paper, they depict a Caribbean plate moving generally from west to east, with the present Panamanian area occurring on the western edge of the plate. However, lateral plate movement over large distances may be more relevant to genera and higher taxa patterns. The fauna of interest to us is seemingly much more closely tied to Tertiary events. These events have been discussed in some detail for eastern Panama and the neighboring portion of Colombia by Haffer (1970). According to Haffer, in the upper Eocene, initial orogeny extended at least into eastern Panama but the actual exposure of any land mass may have been relatively temporary. From the upper Eocene to middle Miocene, Panama and neighboring Colombia were largely submerged with small and largely scattered emergent areas or islands. During the upper Miocene there was a further orogeny with narrow water gaps persisting primarily in western Panama. Again there was subsidence during the lower Pliocene with the formation of three major water gaps, consisting of the Nicaraguan, Panamanian, and Colombian portals. These were closed either in the upper Pliocene or early Pleistocene approximately two million years ago. During some of the glacial periods of the Pleistocene the coastal lowland areas of Panama and adjacent countries were greatly expanded so that the land area was perhaps larger by 20% to 25% than at present. These various events have been diagrammed and discussed by Haffer (1970) along with the problems that exist in the geological interpretation of the sediments in the area. More recent events, including sea level changes and climatic fluctuations of the last 35,000 years, have been discussed as they relate to Panama by Bartlett and Barghoorn (1973).

The geological evidence thus indicates that Panama has been an area of instability. For much of the early Tertiary only small isolated areas of exposed land were present so that any faunal interchange must have been by overwater dispersal. This changing topography undoubtedly strongly influenced speciation and also contributed to numerous extinctions. The fauna, at least in the Scarabaeinae, reflects this. The ranges of the 36 endemic species occurring in Panama and adjacent Costa Rica seem to coincide with one of the main Pliocene - early Pleistocene emergent areas, with the Nicaraguan trench to the north west and the Bolivar (Darien) trench to the east. The sizes of the emergent areas and the length of time that they have remained emergent is not certain.

TABLE 2. SUMMARY OF THE GENERAL DISTRIBUTION PATTERNS OF THE PANAMANIAN SCARABAEINAE AND THE RELATIONSHIP OF THE PATTERNS TO SPECIES SIZE.

WIDESPREAD	PANAMA-S. AMERICA	PANAMA-C. AMERICA	PANAMA-C.R.	PANAMA
42 spp.	13 spp.	22 spp.	18 spp.	18 spp.
average size 10.12 mm	12.08 mm	10.59 mm	9.61 mm	7.0 mm
(10.58 mm)		(11.14 mm)	(8.3 mm)	
	(10.93 mm)			

The difference between 10.93 and 8.3 mm using a t test is significant at about the 7% level. It is significant at the 5% level using the Mann-Whitney U test (a two sided rank sum test).

If Haffer's generalized diagrams are reasonably accurate, then at least some of the Chiriqui or adjacent areas have been exposed since Upper Miocene; i.e., for about the last 5,000,000 years. This length of time certainly has been sufficient to allow a distinctly endemic biota to develop. The length of isolation (or period of emergence) apparently has not been sufficient to be reflected in any degree of endemism at the generic or tribal level within Panama, at least in the Scarabaeinae. However, particularly in the genus *Canthidium*, groups of related species occurring in the Chiriqui area apparently radiated in the western Panama-Costa Rica uplift. It is interesting to note that the degree of endemism is higher among genera composed of small-sized species (under 10 mm) than among genera containing only larger species (Table 2). This in turn may reflect differences in flight behavior as it relates to foraging, which in turn may relate to dispersal.

If, until 2,000,000 years ago, the exposed portions of Panama resembled an archipelago or even an isolated island situation the present fauna, particularly the endemic elements, should reflect this. There are a number of different characteristics exhibited by island faunas, but if one examines the species listed in Matthews'(1966) work on the Scarabaeinae of the West Indies, it is obvious that a large percentage of the fauna is composed of relatively small species (10 mm or less). Genera such as *Dichotomius*, *Phanaeus*, *Eurysternus* and *Deltochilum* are common in surrounding mainland localities and generally are of moderate to large size (15 mm or more). In the West Indies only Jamaica has one large endemic species, *Phanaeus carnifex* (L.). This species, measuring from 17 to 23 mm in length, lacks any really close relative, the most closely related species occurring in northern South America. In general the small size of island Scarabaeinae is not a unique feature as Darlington (1970) has also noted the same characteristic for Carabidae occurring in the West Indies. If species size does have any relationship with island or habitat isolation, then, based on Haffer's (1970) geological history of Panama, endemic forms in Panama should have a smaller average size than more wide ranging forms if Panama were an archipeligo in the recent past. Also, genera occurring in Panama that contain a number of endemic species, in theory, should be composed of mainly small species with their closest relatives in nearby localities. This is true at least for *Uroxys* and *Canthidium*. Also the species endemic to Panama and the adjacent area of Costa Rica average 8.3 mm in length while the widespread (1), Panama-South America (2), and Panama-Central America (3) groups average 10.12, 12.08, and 10.59 mm respectively. Thus the size as well as the location of the endemics seems to coincide with the past geological events of the mid to late Tertiary as they relate to Panama.

Because of the preliminary nature of the present study, the numerous unsolved taxonomic problems, and spotty collecting coverage, further comments on faunal relations are not justified.

HABITS: COMMENTS ON THE BEHAVIOR OF A FEW SPECIES

Since this work is primarily concerned with the identification of the Panamanian Scarabaeinae, details of behavior that have been observed on a number of species will be omitted as they have been or will be published elsewhere. It does seem appropriate, however, to briefly summarize the major feeding habits of the Panamanian species and to mention briefly a few of the more interesting aspects of some of the current behavioral work that has been completed or that is still under investigation.

The known habits of the Scarabaeinae have been well summarized by Halffter and Matthews (1966). Their work outlines the variety of food utilized by some members of the subfamily. In our study of the Panamanian species, we have found that the food preferences largely seem to follow the general patterns as described by Halffter and Matthews (1966). In general the species are attracted to mammal dung, while some show a preference for carrion. Frequently species may be attracted to both dung and carrion. Other foods utilized by fewer species are decaying vegetation, fungi, and rotting fruit. Again, in some cases, species going to rotting fruit may also be attracted to dung and/or carrion. Examples of this type of behavior can be found within the genus Onthophagus. As noted by Halffter and Matthews (1966), it seems that most species of Scarabaeinae have the capability of utilizing more than one type of dung or rotting material. Many species undoubtedly have a food preference but this aspect has not been thoroughly investigated for the majority of species.

Once the dung or other food material has been located it appears to be expedient for the beetles to move it as rapidly as possible. This need for rapid removal seems to be a response, at least in part, to the number of species competing for the resource. In Panama, as many as 22 species have been taken in one locality at traps baited with human feces. The number of species competing for the resource is probably only part of the story since individuals of the same species may also compete (see Matthews, 1963). The response to this competition has been the development of several methods of rapid food handling that essentially remove the food from the competitive arena. One method is to immediately dig a burrow under the food mass and bury a quantity of the dung or carrion. Once the food is in the burrow it may be eaten or formed into a brood cell.

Some species may actually push (butt) pieces of the dung for a short distance and then bury it, while other species (members of the genus Canthon, for example), may form the food material into a ball and roll it for a considerable distance before burying it. In all cases, after burial, the food may be consumed by either the adults or utilized in a brood cell for larval food.

Details of the types of brood cells and mention of brood care may be found in papers by Bornemissza (1969), Halffter (1977), and Lengerken (1954). Normally, development of the brood is fairly rapid with the period from egg to adult frequently occupying between 30 and 50 days. In areas with a prolonged dry season, either the pupa or teneral adult may remain in the brood cell until there is sufficient moisture in the ground to allow the adult to emerge, thus limiting the reproductive cycle to one generation per year. However, in Panama there are frequently a number of generations per year but there may be differences in the size of species populations between the wet and dry seasons. Seasonal population fluctuations of dung beetles have been studied carefully in only a few areas. On Barro Colorado Island, the scarabaeine biomass in the mid-dry season (Feb.) is estimated to be six times larger than in the mid-wet season (Sept.). The biomass of all insect species captured at light traps, however, is approximately the same for February and September (Smythe, 1974). The increase in biomass that occurs in most insect groups with the start of the wet season (Wolda, 1978) does not occur in most species of Scarabaeinae, at least on Barro Colorado Island.

Several factors can be correlated with the higher biomass of scarabaeines in the dry season on Barro Colorado Island. The population density of vertebrate dung-producers is probably lowest during the mid-late wet season, due at least in part to high mortality because of the scarcity of fruit, new leaves, flowers, insects, and other foods typically consumed by vertebrates (Young, 1978). Thus the production of vertebrate dung is also correspondingly lowest in the wet season. The availability of that dung to scarabaeines is probably lowest during the late wet season, due to the action of heavy rains on exposed dung with the subsequent rapid loss of aromatic properties and dissolution. With both the production and the availability of vertebrate dung lowest in the mid-late wet season, the life-history strategy of each dung-consuming scarabaeine must include some mechanism for surviving food scarcity at that time. The dominant diurnal and nocturnal species, *Canthon angustatus* and *C. aequinoctiale* respectively, utilize a greater proportion of the available dung during the late wet season and are reproductively active throughout the entire year. Some other species are not present as adults during the late wet season. Instead they are below ground in the larval or pupal stage and emerge at the start of the dry season. Still other species change their feeding habits. During the late wet season they feed as adults on vertebrate carrion, which is relatively more available to scarabaeines during this period (Young, 1978).

The availability of food and the number of individuals competing for the food may have not only led to the development of methods of rapid food removal but have apparently also influenced the evolution of different foraging techniques. Typically, beetles locate dung, carrion, or rotting vegetation by the detection of odors. The species generally pursue a laterally sinuous flight pattern moving upwind, the pattern becoming narrower as they approach the source of the odor. Normally, the majority of species fly only a few feet above the ground and are able to land either on or close to the odor source. While this type of foraging behavior; i.e., flying upwind, is typical of most species, there are a number of variants that have developed on the basic pattern; an example of this is found in the species *Canthon angustatus*. On Barro Colorado Island it is perhaps the most common species during all or most of the year. Normally, when food odors are first detected, individuals leave their burrows, take flight, and follow the airborne odor trail upwind to the odor source. Individuals that arrive in the vicinity of the odor source within the first few minutes after defecation by a vertebrate are usually able to locate and land on the food. Individuals that arrive later are usually unable to determine the exact location of the food and after several minutes of flying in the vicinity land on leaf surfaces. Failure to detect the odor source is probably due to decreasing production of odor and confusing local convection currents. Individuals that are thus unsuccessful in locating food are the ones that perch on leaves. They are in the best position, however, to locate food subsequently produced in the same area.

While foraging near the ground is common, not all species utilizing this method can locate rotting fruit or dung lodged above the surface of the ground. Howler monkey dung, for example, may lodge on branches or leaves in the upper levels of the canopy. A few species apparently have developed capabilities of locating and utilizing arboreal food sources. On Barro Colorado Island, observations made from a 65 foot high weather tower in the forest indicate that at least two species, *Canthon angustatus* and *C. subhyalinus*, have a three dimensional capacity to locate food odors. This was apparent when howler monkey dung was placed at the top of one of the towers. All responding species could be seen flying towards the tower at a height above the ground of 15 to 60 cm. Near the base of the tower, *C. angustatus* and *C. subhyalinus* changed their elevation, flying upwards to the top of the tower. The other species maintained their original elevation, flying around in circles in the area where the odor trail from the tower feces apparently reached the ground. Thus only in situations where arboreally-produced feces fell all the way to the ground would those species with two-dimensional odor detection capabilities compete for its possession.

Another type of possible foraging behavior is leaf perching as suggested by Howden and Nealis (1978). Actual reasons for perching on leaves are seemingly complex and varied but unpublished data from Panama and Ecuador has shown that small species in certain genera, particularly species in *Canthidium*, tend to be found perching more frequently and closer to the ground than do larger species in other genera. Howden and Nealis (1978) postulated that flying above the low level vegetation or along trails at an average height of about 1 meter allows a species to detect relatively strong odors that would be given off by a large quantity of food. Small food sources might be better detected by perching near the ground in favorable areas. This postulate was later tested by setting large dung traps baited with 100-200 cc of human feces and small traps with 2 cc of the same bait. Both average size and species composition varied between the 100-200 cc and 2 cc baits with some species being taken only in traps of one size (unpublished data of H. Howden and S. Peck). Exactly what types of behavior cause the species and size differences in the different traps remains an interesting question and one that obviously needs further investigation.

Another type of behavior that has only been partly investigated might be categorized as a form of olfactory communication. Young, working in Panama, noted that when *Canthon angustatus* individuals were active at monkey droppings, individuals of its principal competitor, *Canthon lamprimus*, surrounded the fecal material at a distance of approximately 15 cm. They then remained at this distance until most individuals of *C. angustatus* left the site. Laboratory experiments by Young indicated that in a one-to-one confrontation at a limited food site, *C. angustatus* was competitively superior to *C. lamprimus*, depriving the latter of food when it was in short supply. Field observations supported this data by indicating an avoidance of *C. angustatus* by *C. lamprimus*. Further investigation led to the observation that a white viscous fluid, secreted from the anal area of *C. angustatus* and coated over most of the body, appeared to be an aromatic substance. This substance functioned as an allelochemic since in laboratory olfactometer tests *C. lamprimus* attempted to avoid filter paper saturated with the substance. The ecological consequence of this is that when monkey fecal material becomes less available in the wet season, *C. lamprimus* adults may either die or shift to carrion as a food source whereas *C. angustatus* continues to utilize the monkey feces.

There are many other aspects of Scarabaeinae behavior that need investigation. Mammals often tend to utilize trails and move in groups. Do dung beetles follow these potential food sources or locate them visually or by sound? There is some very tenuous evidence that at least a few species may do so by either method.

To date, information concerning the behavior and ecology of neotropical scarabaeines is generally of a fragmented and anecdotal nature, with very few studies on single species and a complete absence of published research on community dynamics. This situation has been due in part to an unstable taxonomy of the group. Material presented in this review will hopefully provide that stable taxonomic base and also give some indication of the fascinating and diverse biologies found in the Scarabaeinae. Hopefully this work will encourage and facilitate further research.

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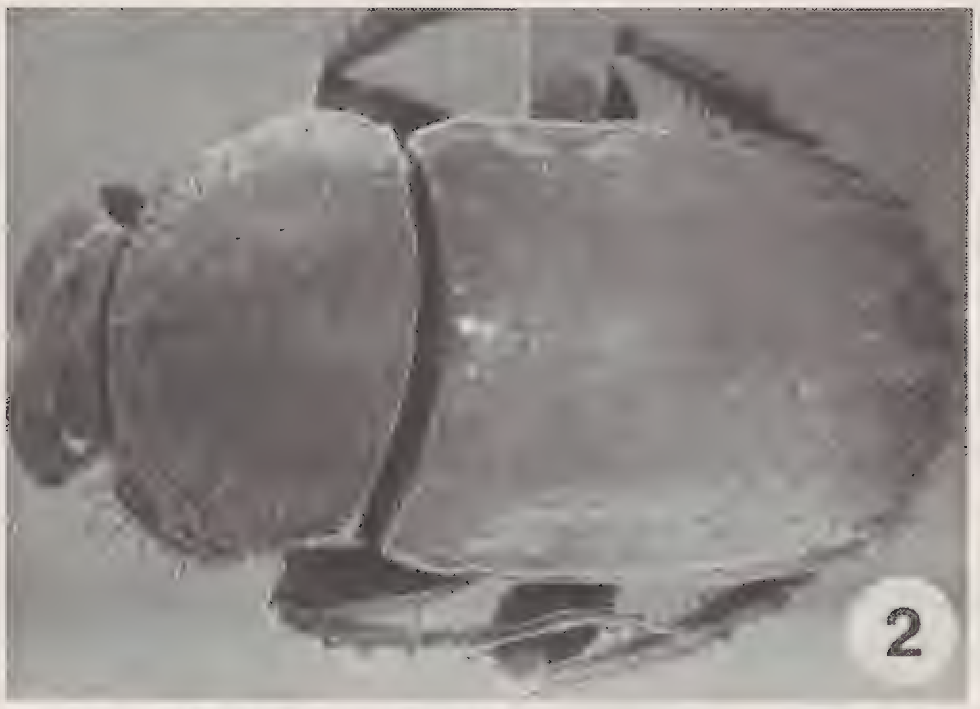
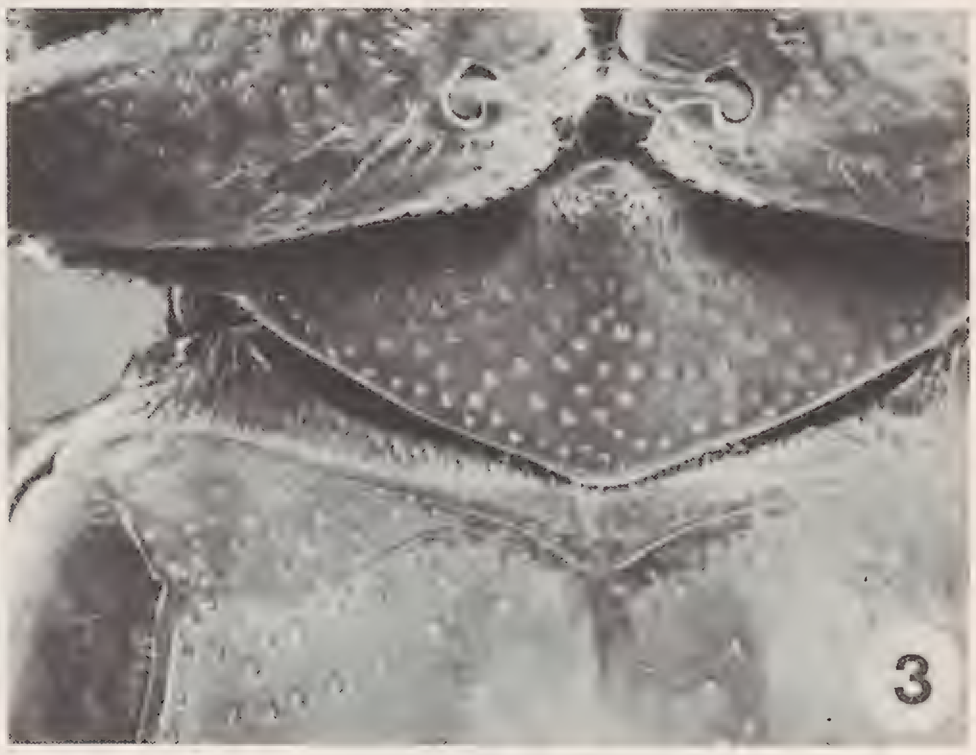
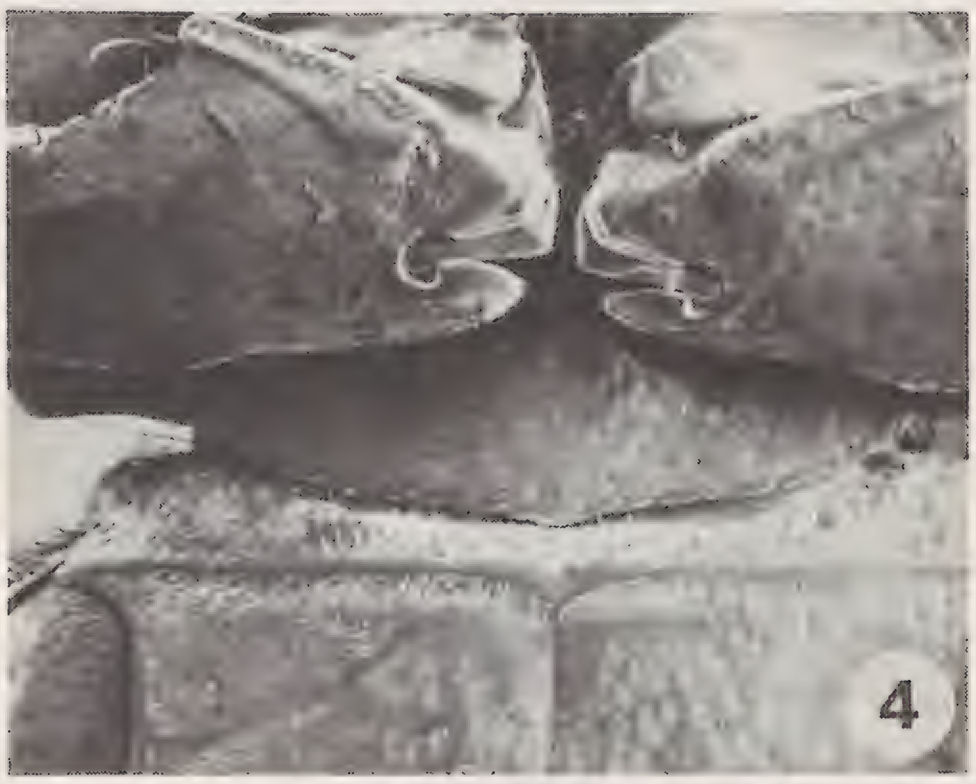
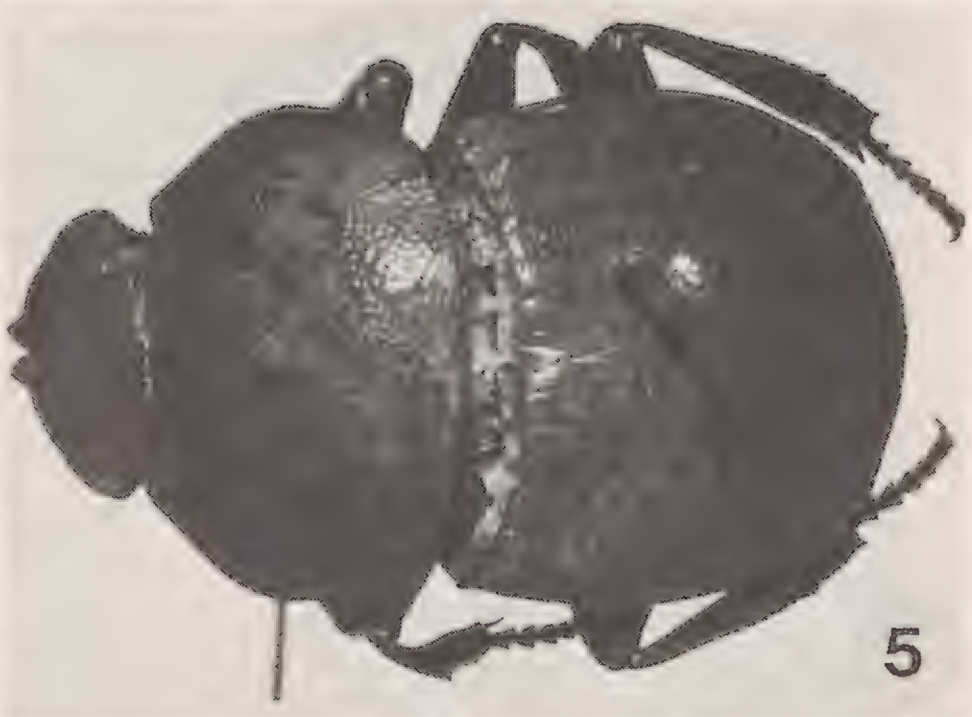
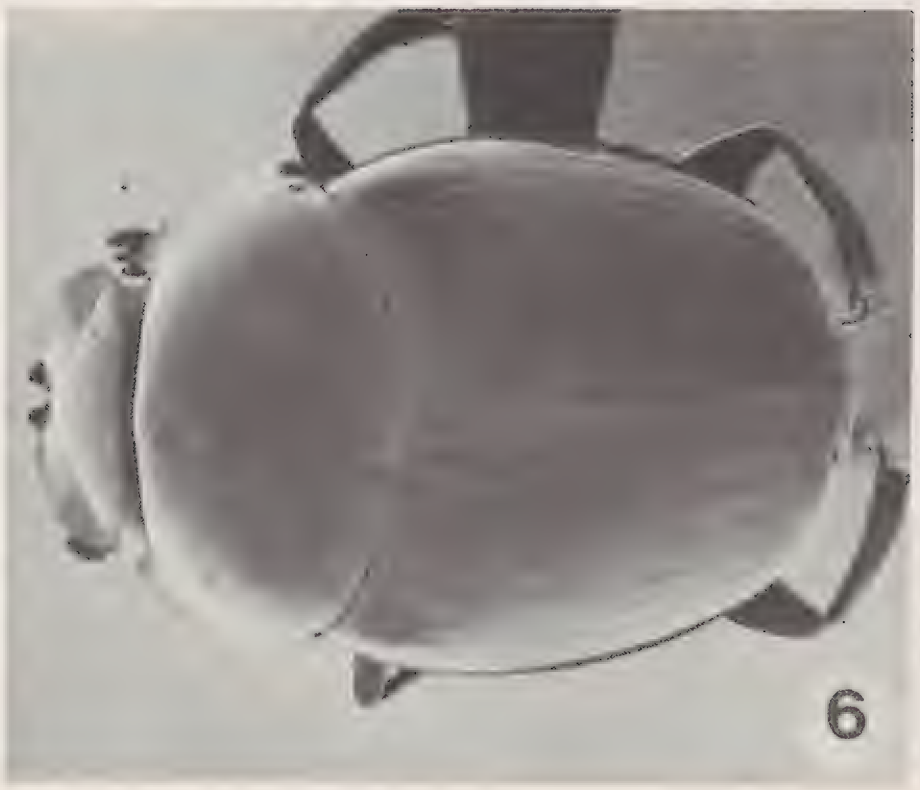










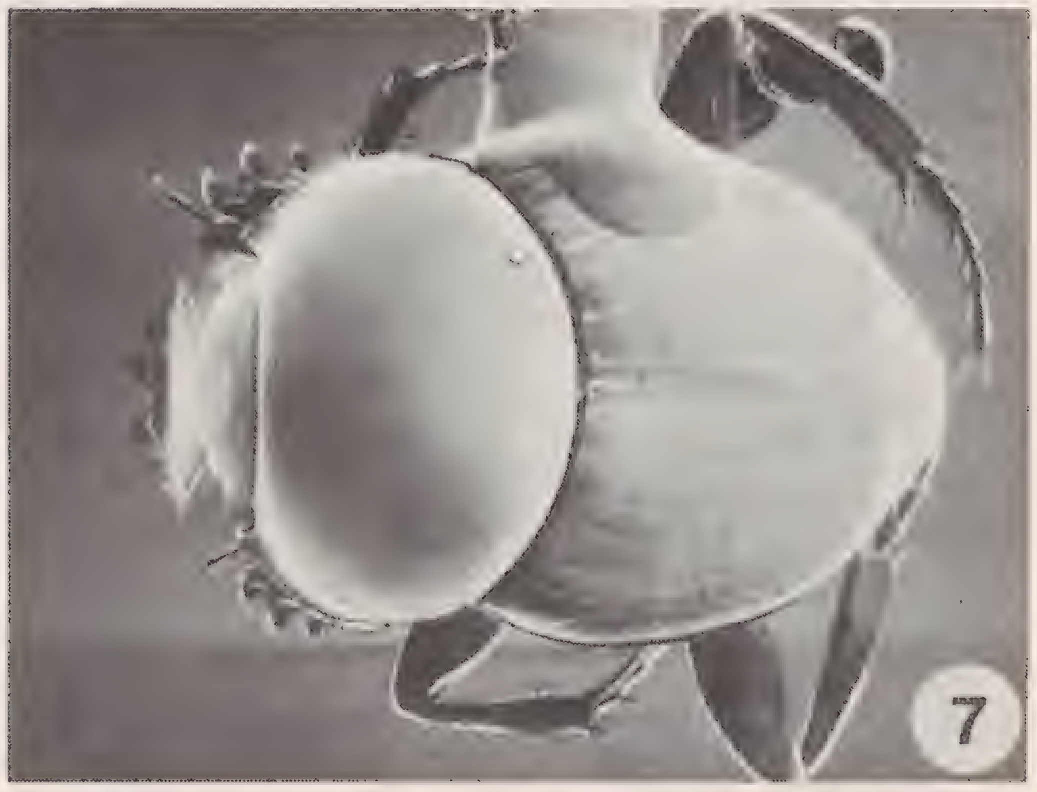
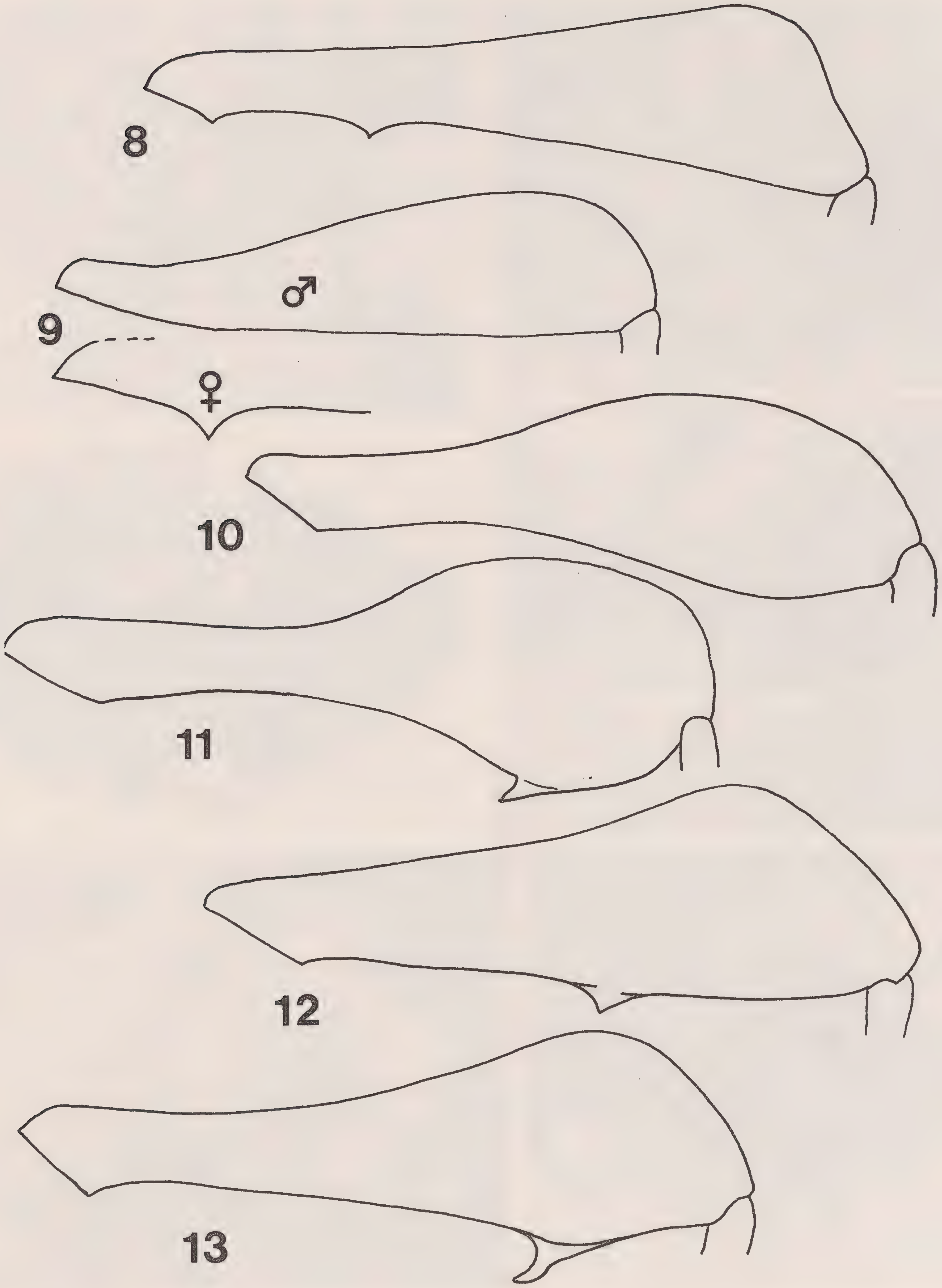
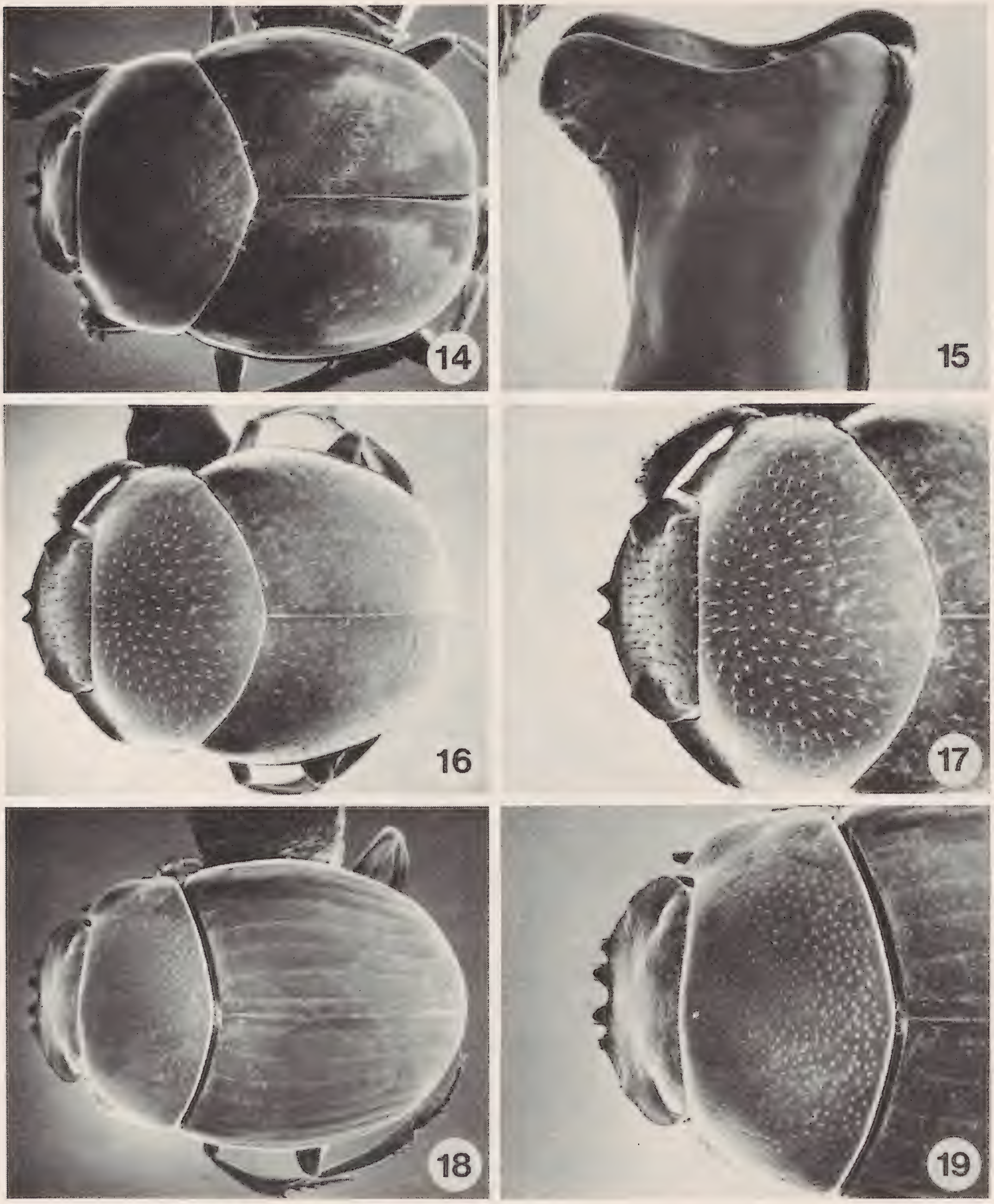


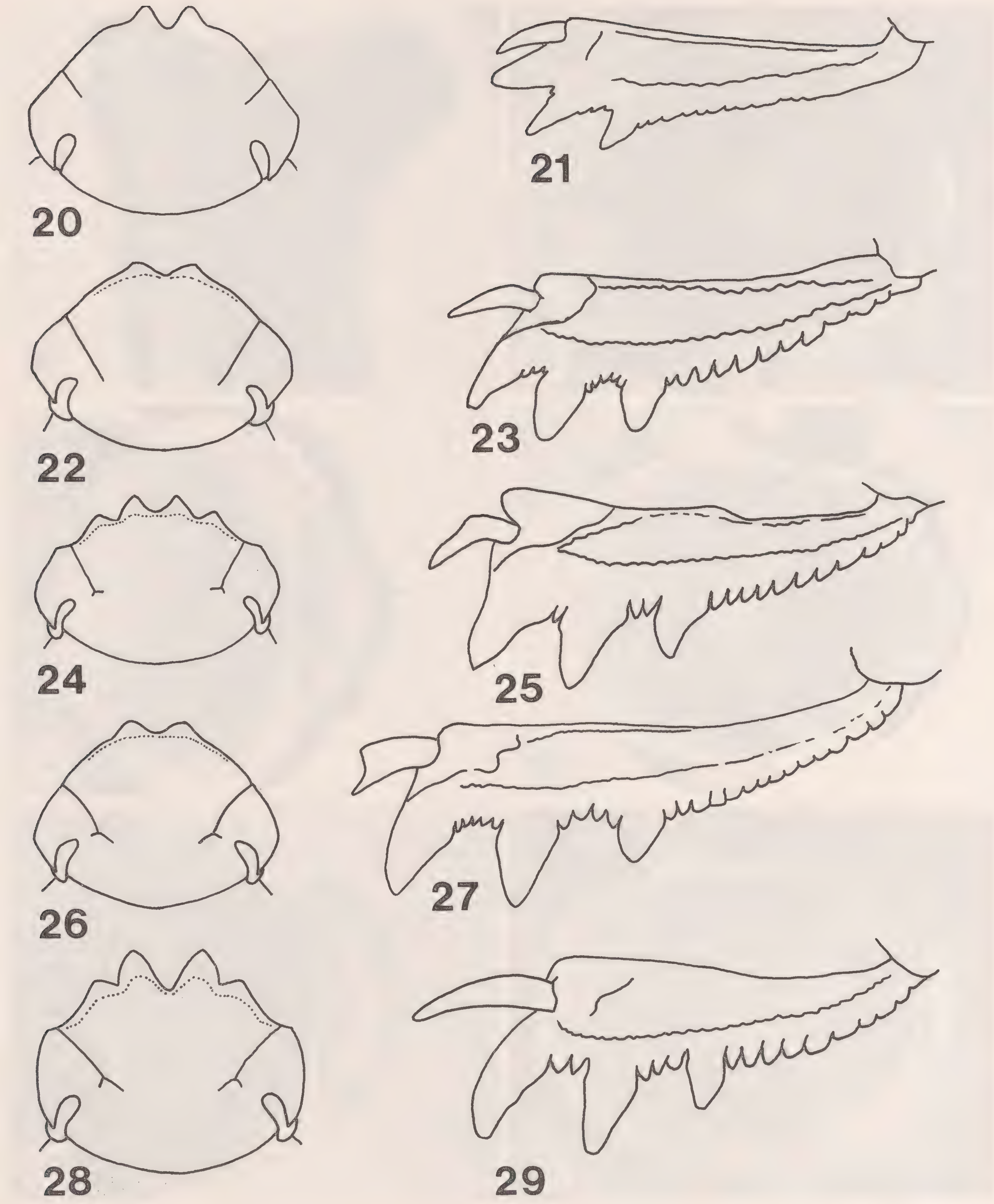
Fig. 2. *Eurysternus plebejus* Har., dorsum. Fig. 3. *Eurysternus caribaeus* Hbst., thoracic sterna. Fig. 4. *Eurysternus mexicanus* (Germ.), thoracic sterna. Fig. 5. *Megathoposoma candezei* (Har.), dorsum. Fig. 6. *Canthon moniliatus* Bates, dorsum. Fig. 7. *Canthon lituratus* (Germ.), dorsum.



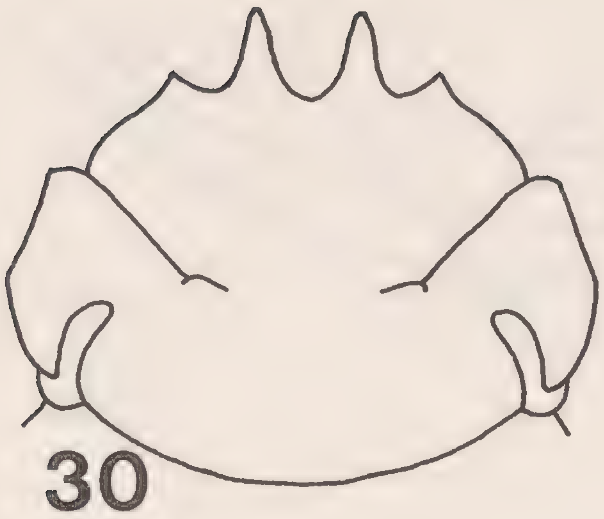
Figs. 8-13. *Eurysternus* spp., left hind femur, ventral view. 8. *claudicans* Kirs., female. 9. *plebejus* Har., male and female. 10. *velutinus* Bates, female. 11. *mexicanus* Har., male. 12. *caribaeus* Hbst., female. 13. *magnus* Lap., female.



Figs. 14, 15. Canthon morsei group. Fig. 14. Dorsum. Fig. 15. Male genitalia. Figs. 16, 17. Canthon juvencus Har. 16. Dorsum. 17. Head and pronotum. Figs. 18, 19. Pseudocanthon perplexus (LeC.). 18. Dorsum. 19. Head and pronotum.



Figs. 20-29. Canthon spp., head and male fore tibia respectively. 20, 21. moniliatus Bates. 22, 23. septemmaculatus (Latr.). 24, 25. deyrollei Har. 26, 27. i. chevrolati Har. 28, 29. literatus (Germ.).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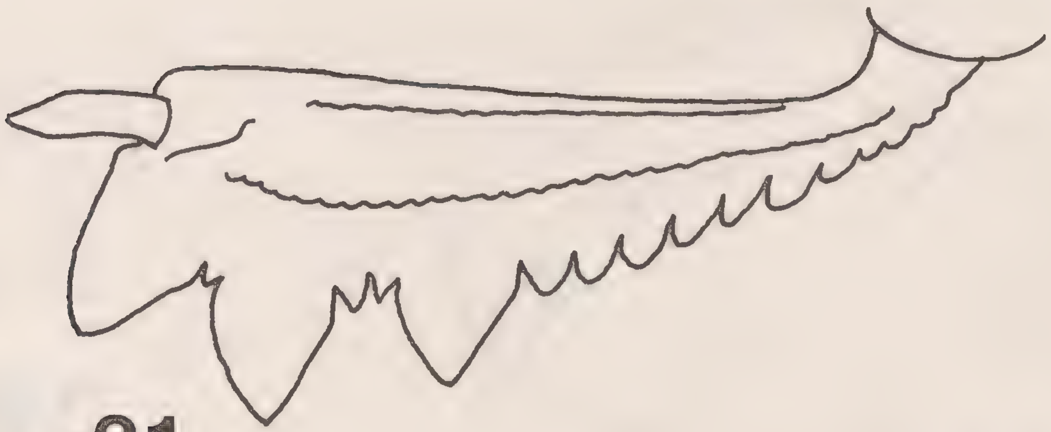
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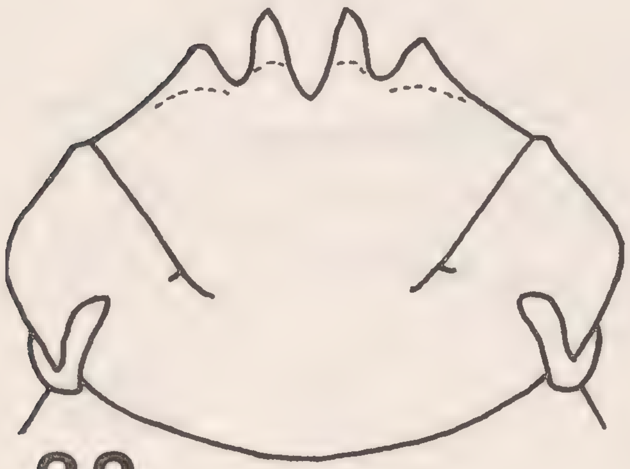
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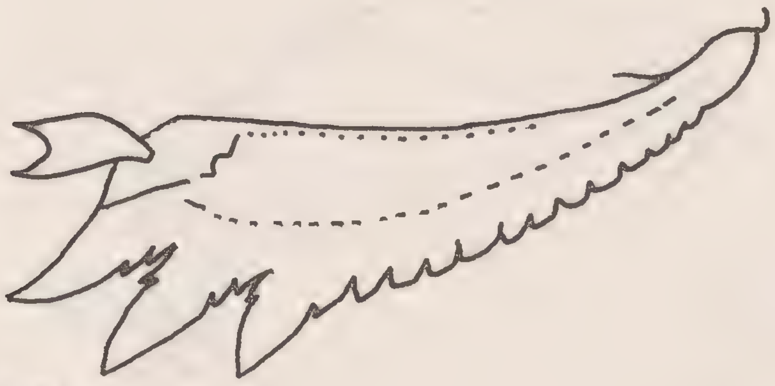
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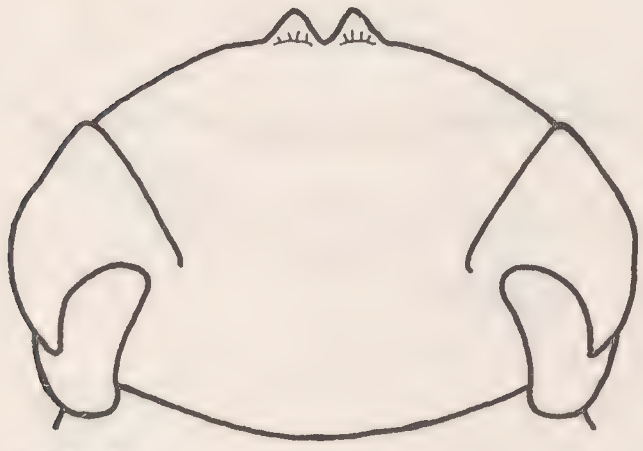
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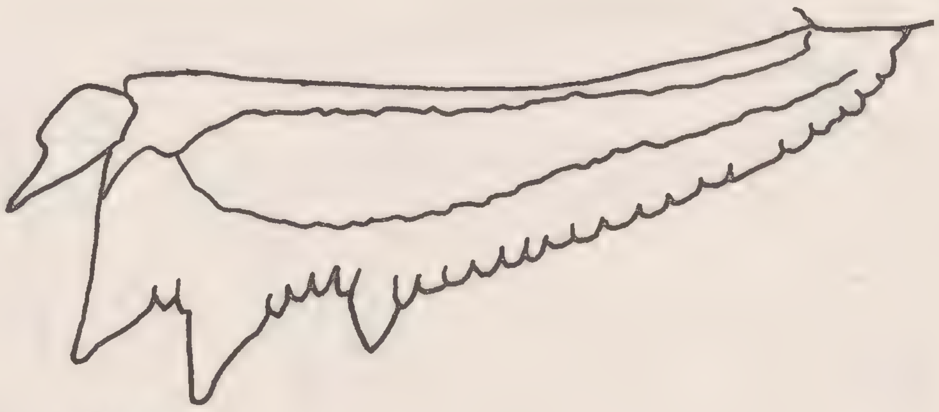
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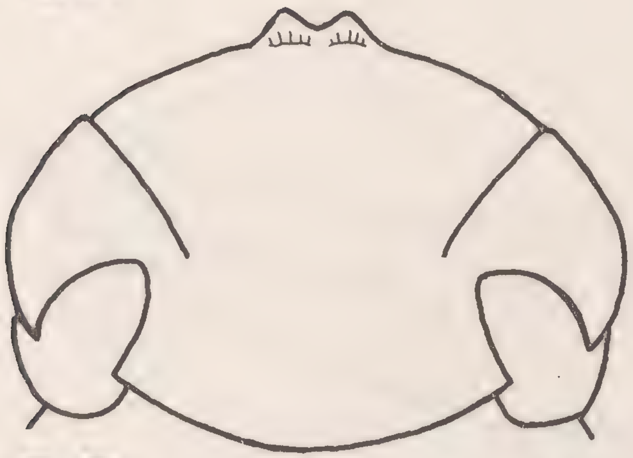
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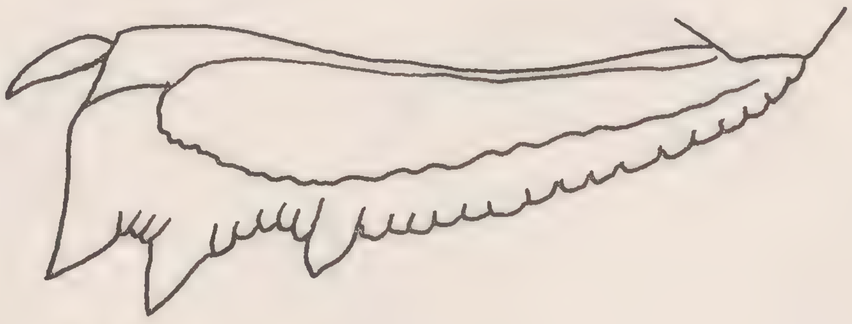
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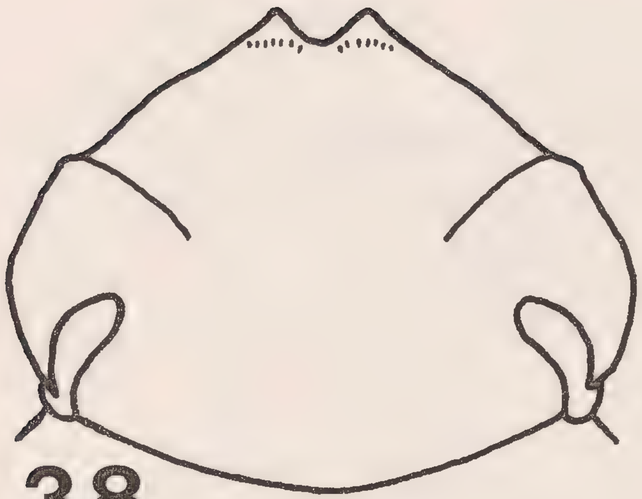
Figs. 30-37. *Canthon* spp., head and fore tibia respectively. 30, 31. *mutabilis* Lucas, male. 32, 33. *c. sallei* Har., male. 34-37. *aequinoctialis* Har.; 34, 35. Male. 36, 37. Female.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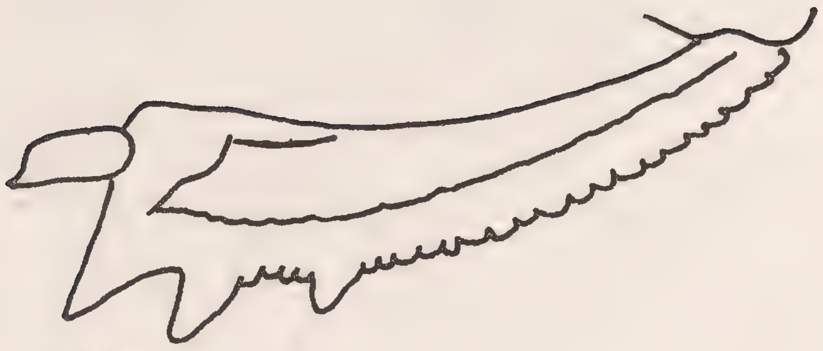
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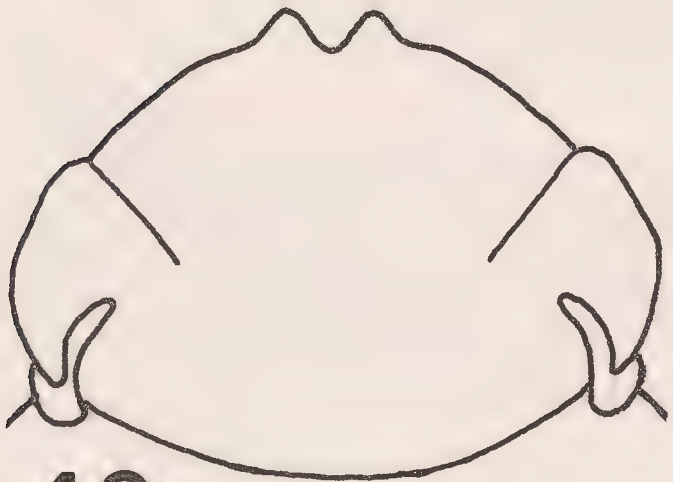
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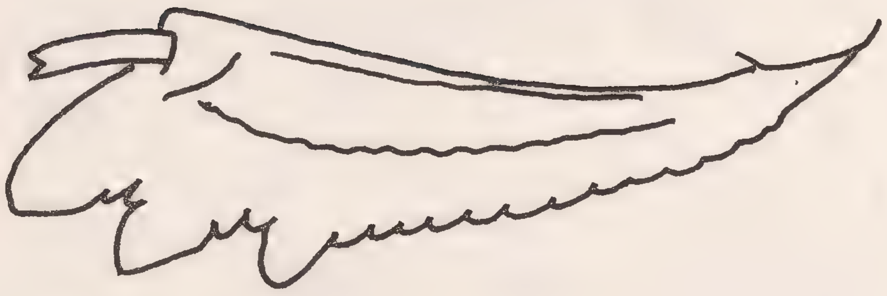
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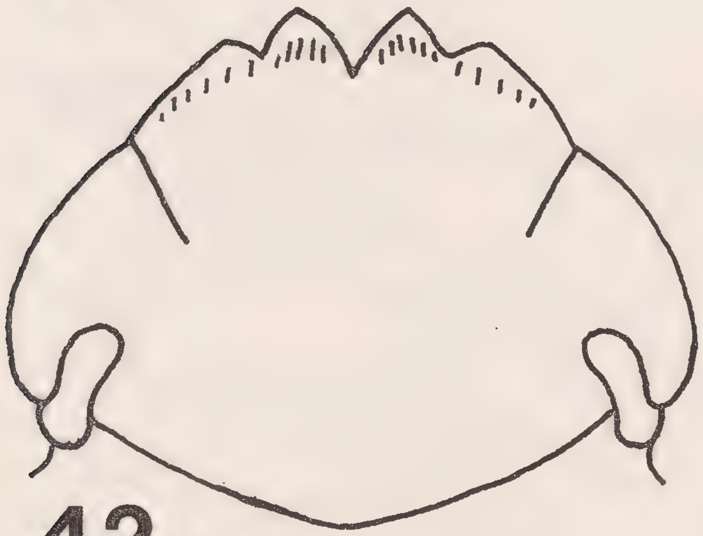
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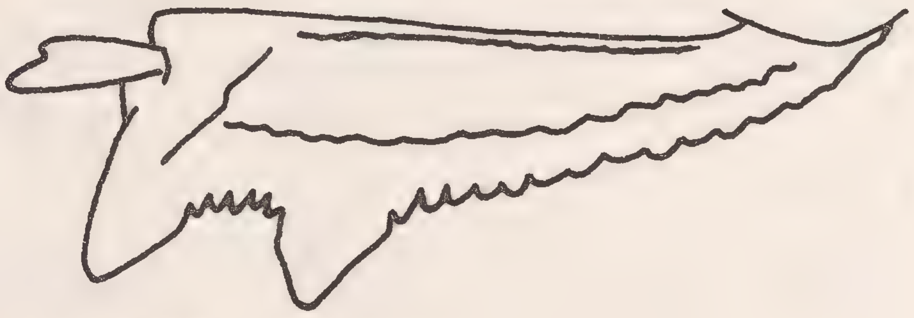
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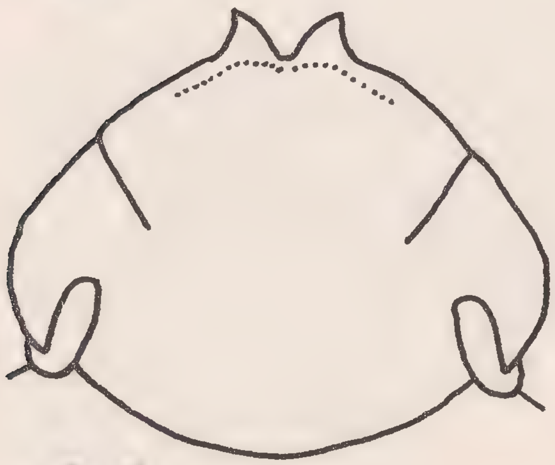
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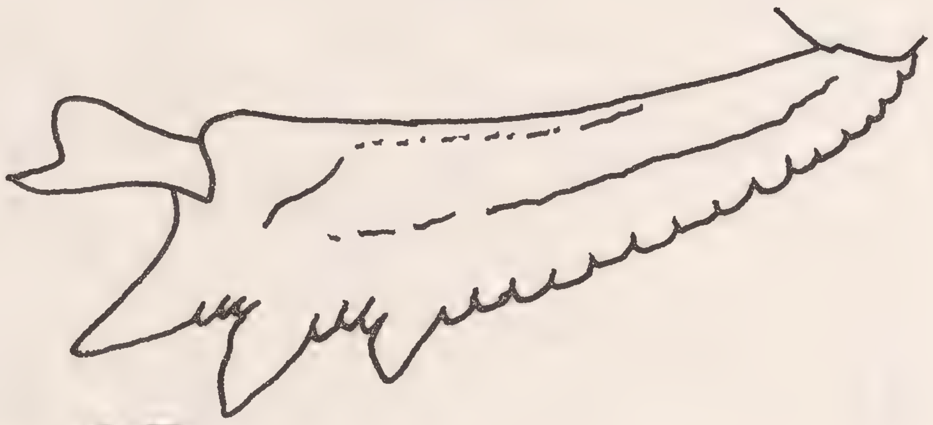
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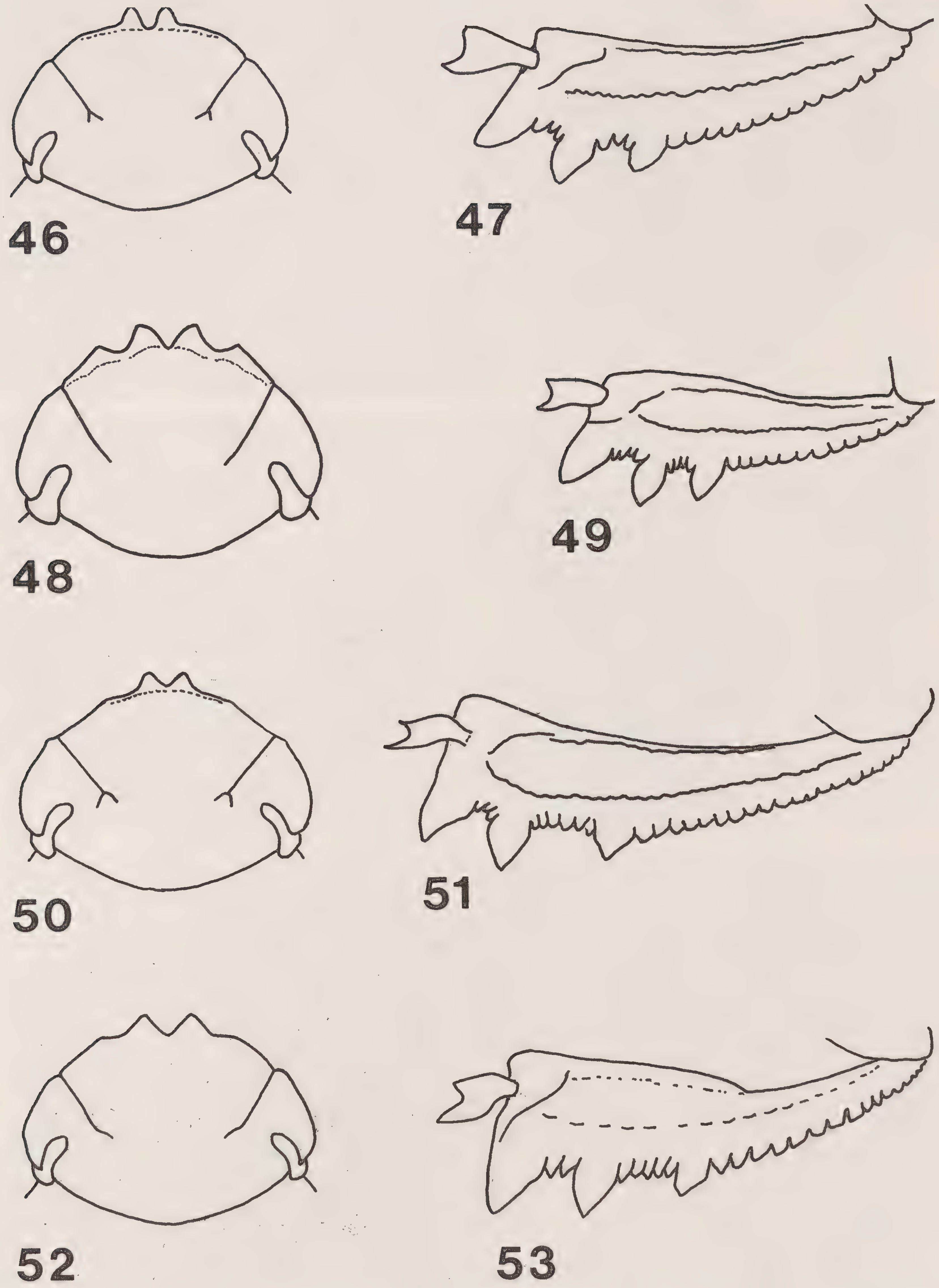
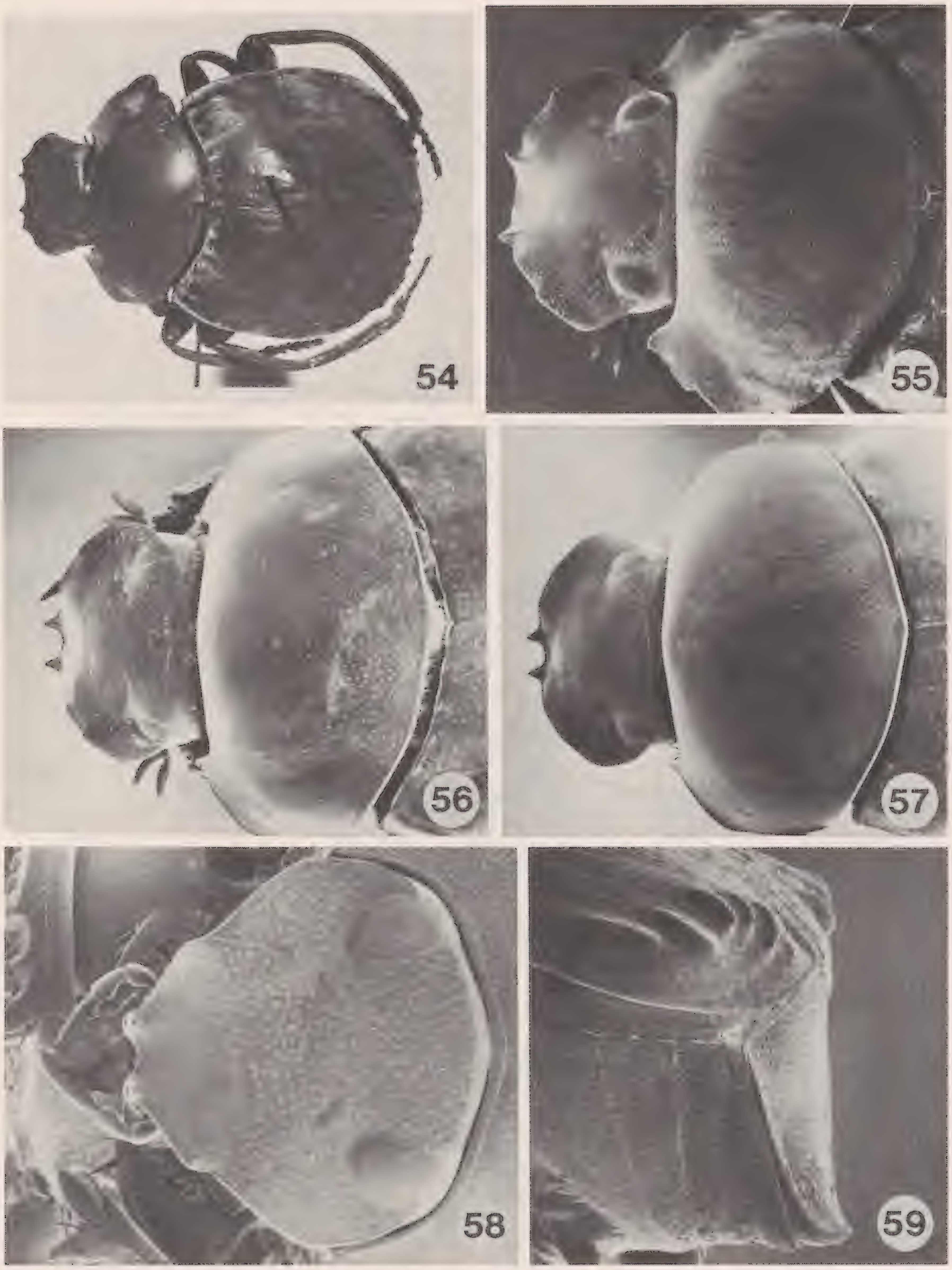
Figs. 38-45. *Canthon* spp., head and male fore tibia respectively. 38, 39. *juvencus* Har. 40, 41. *morsei* group. 42, 43. *angustatus* Har. 44, 45. *subhyalinus* Har.



Figs. 46–53. *Canthon* spp., head and male fore tibia respectively. 46, 47. *euryscelis* Bates. 48, 49. *femoralis* (Chev.). 50, 51. *lamprimus* Bates. 52, 53. *v. meridionalis* M., H. & H.



Figs. 54-59. *Deltochilum* spp. 54. *g. panamensis* Howd., dorsum. 55. *mexicanum* Burm., head and pronotum. 56. *parile* Bates, head and pronotum. 57. *pseudoparile* Paul., head and pronotum. 58-59. *v. acropyge* Bates. 58. Head. 59. Abdomen and pygidium, lateral view.

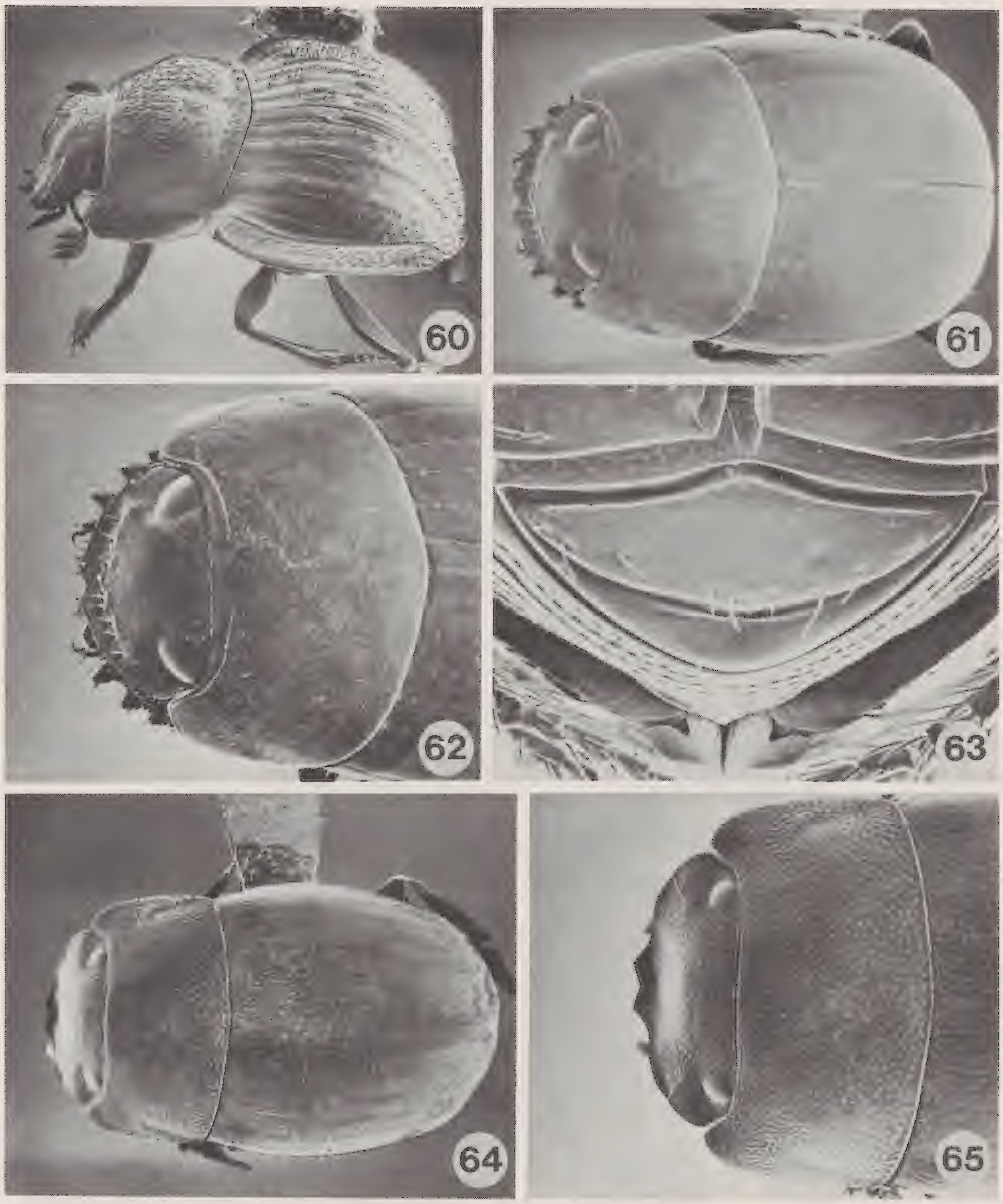
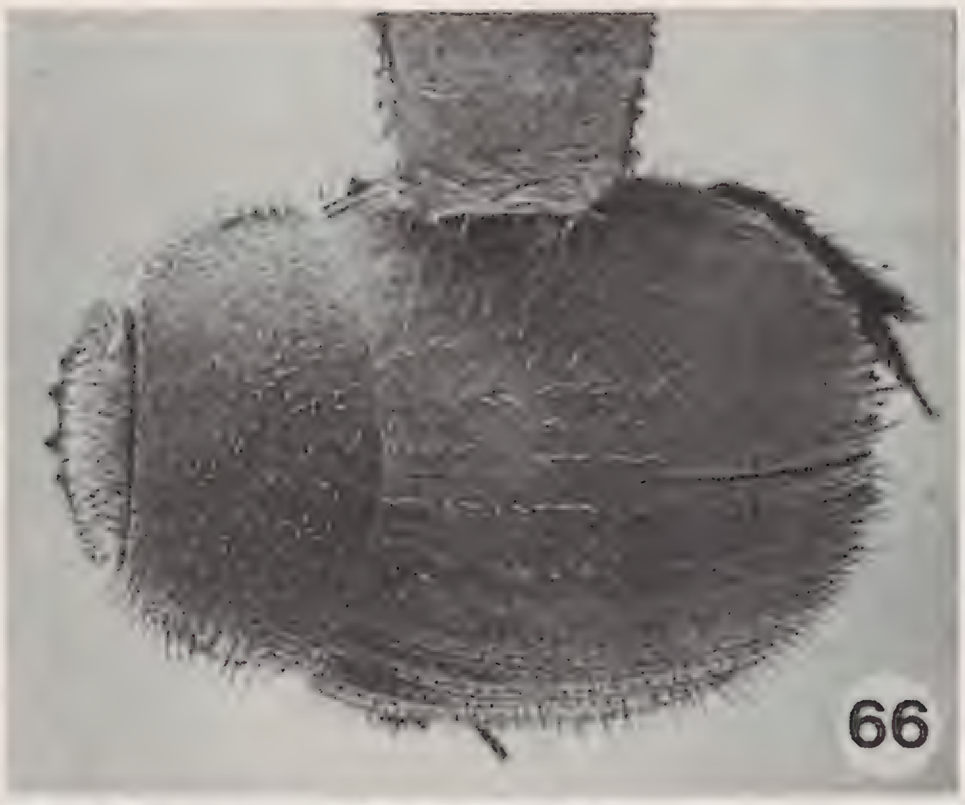


Fig. 60. Cryptocanthon newtoni Howd., dorsum. Figs. 61-63. Agamopus lampros Bates. 61. Dorsum. 62. Head and pronotum. 63. Pygidium. Figs. 64, 65. Bdelyrus seminudus (Bates). 64. Dorsum. 65. Head and pronotum.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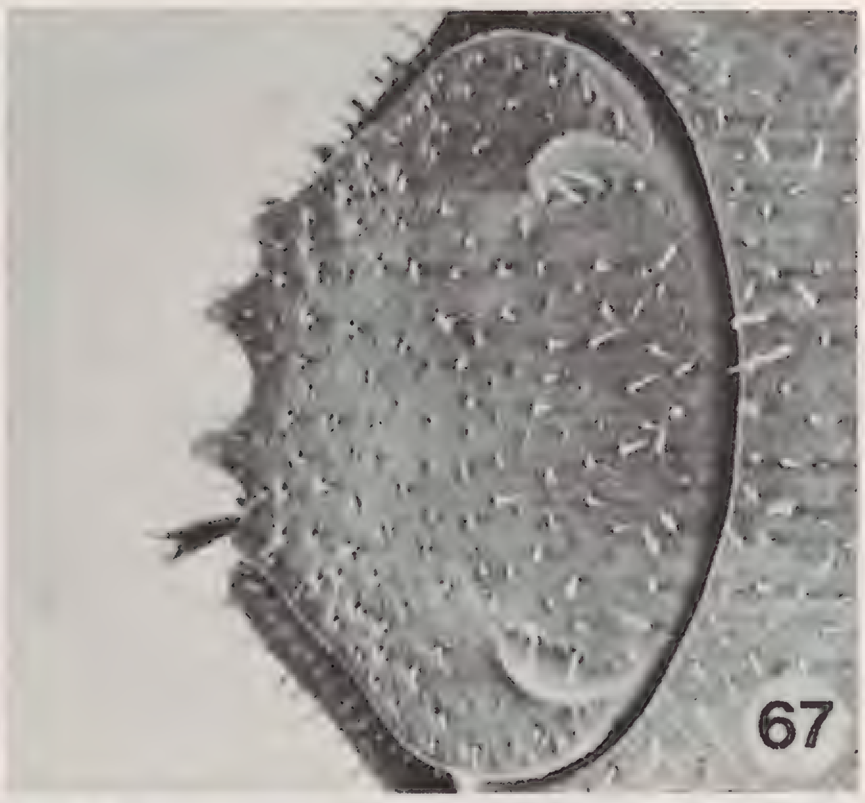
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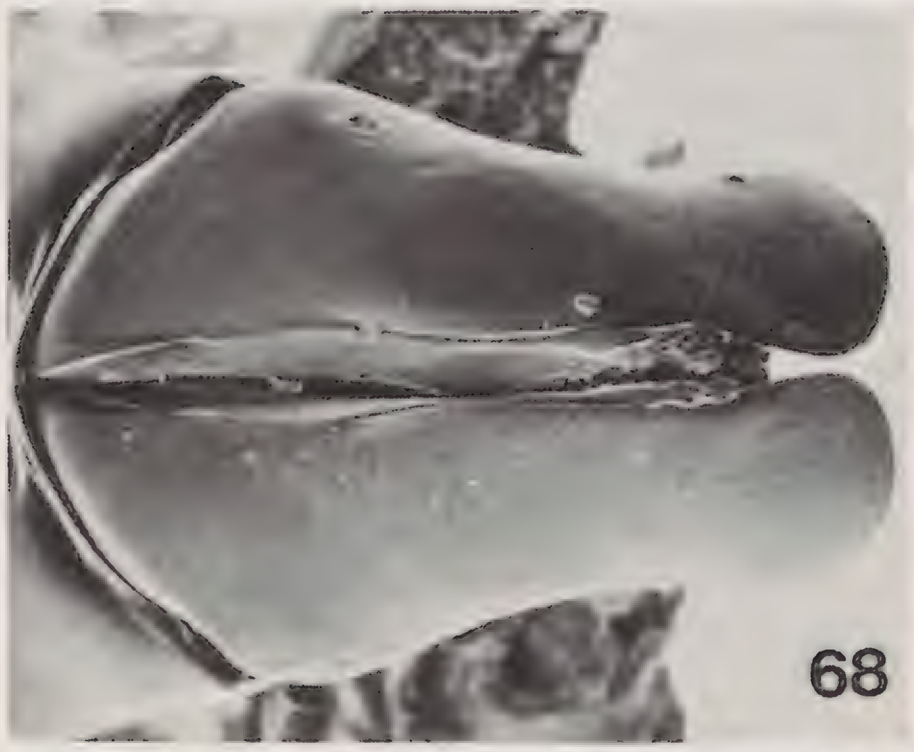
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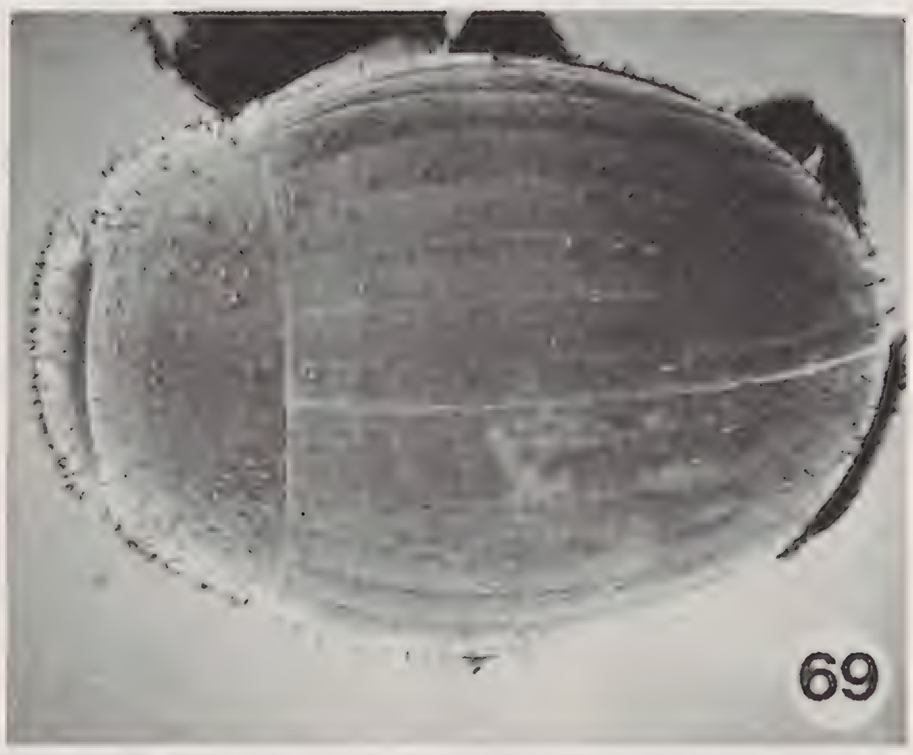
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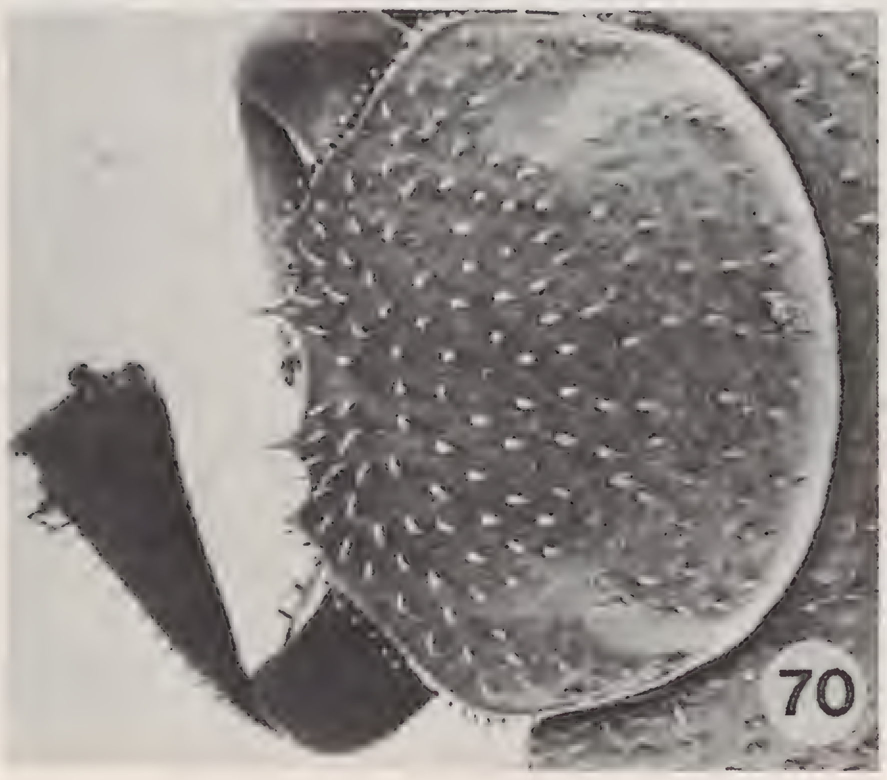
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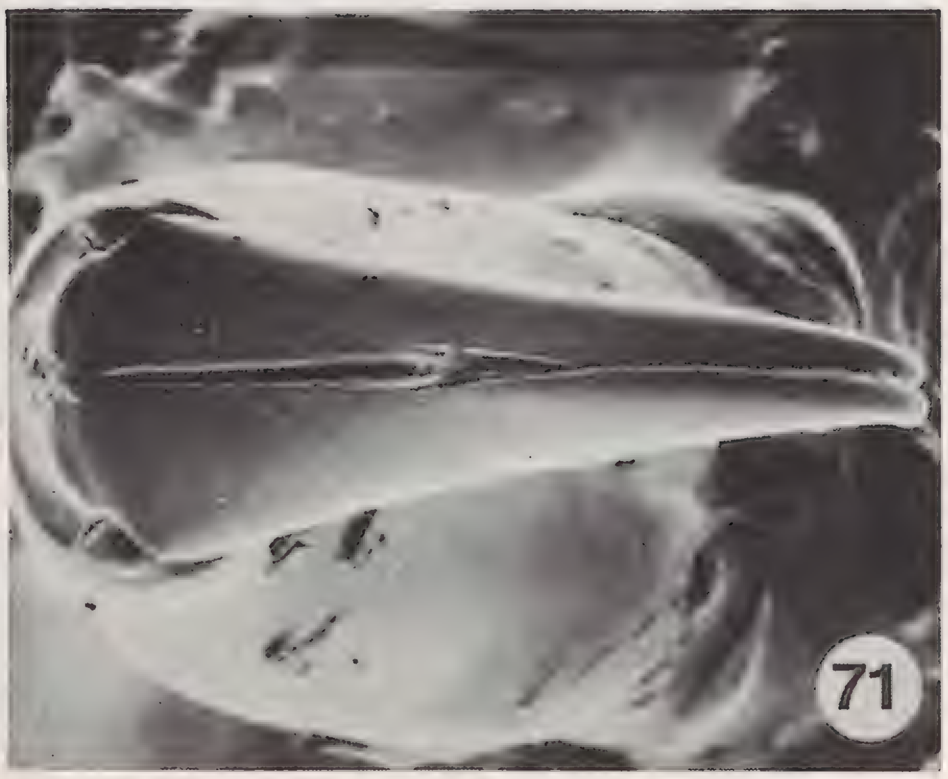
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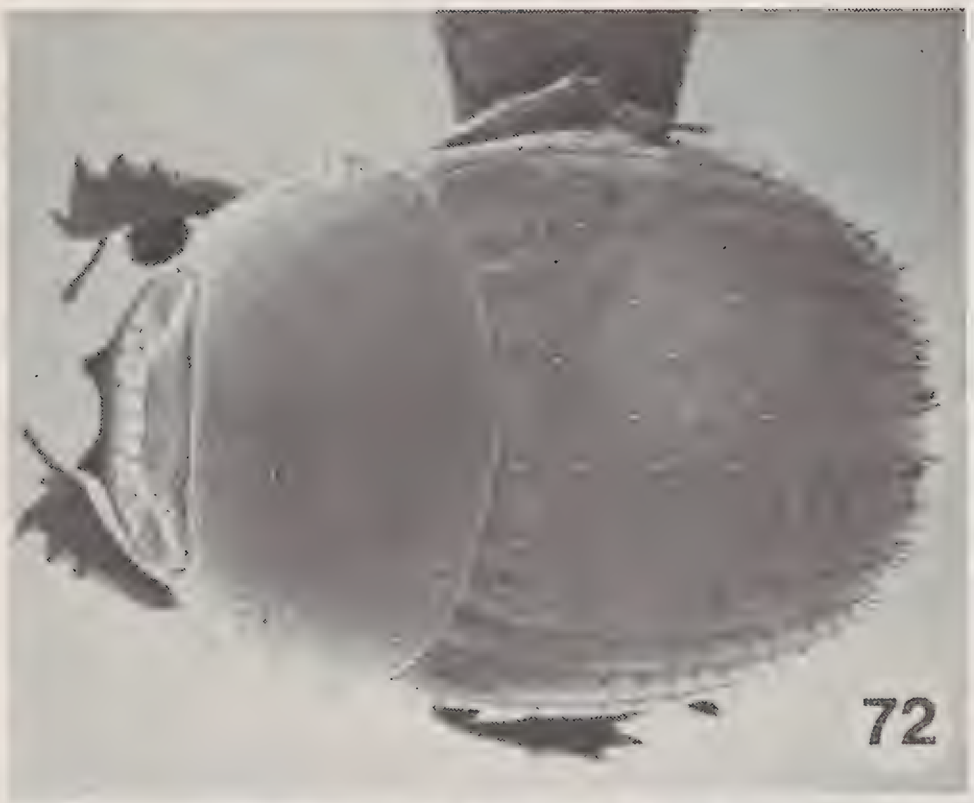
Figs. 66-68. Pedaridium pilosum (Rob.). 66. Dorsum. 67. Head. 68. Male genitalia, apical dorsal view. Figs. 69-71. Pedaridium brevisetosum n. sp. 69. Dorsum. 70. Head. 71. Male genitalia, apical dorsal view.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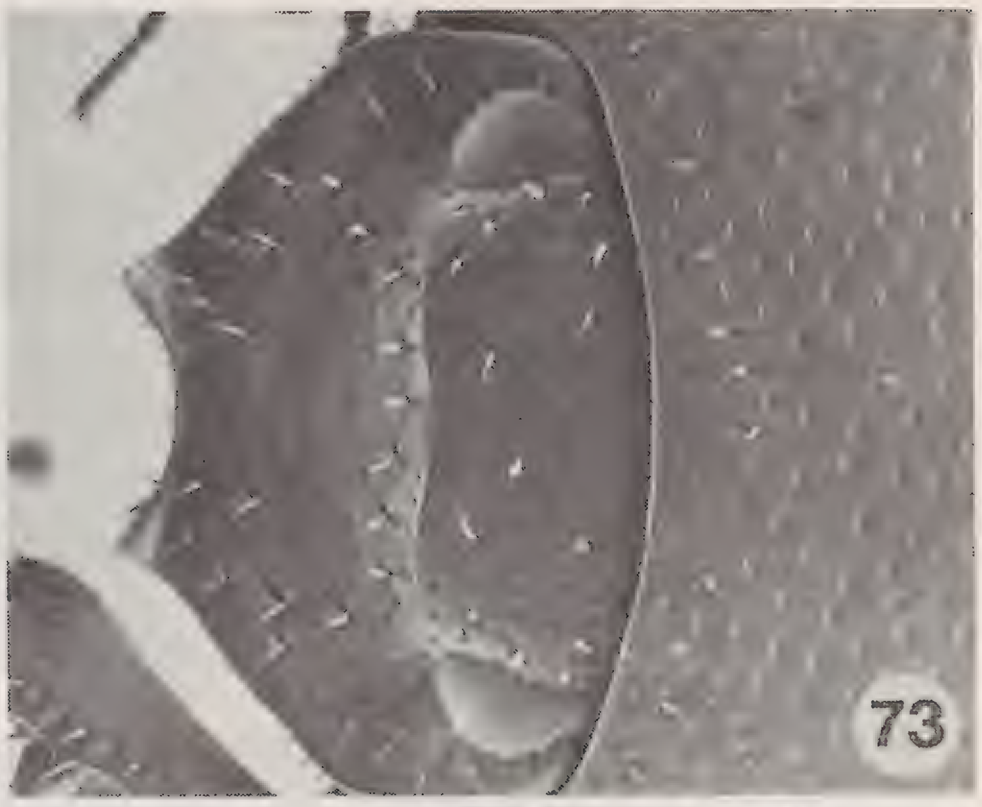
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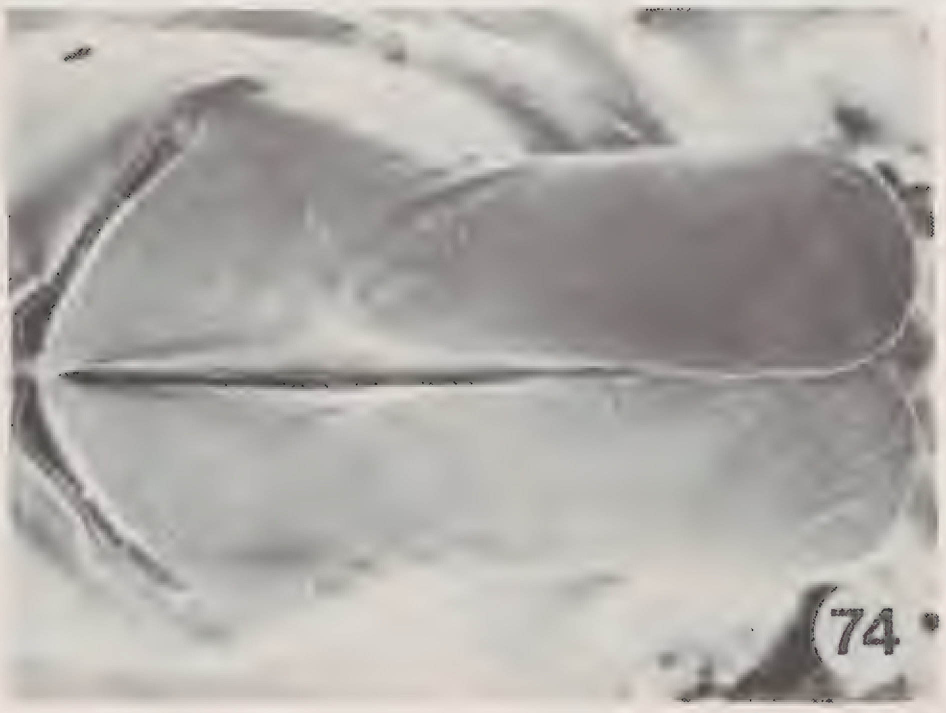
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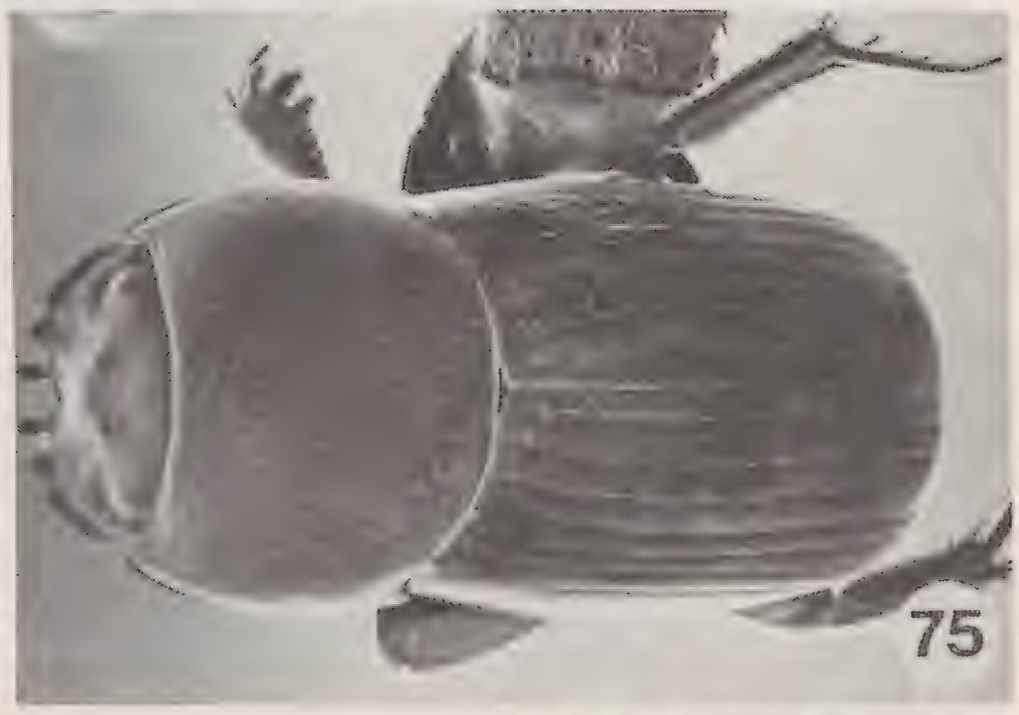
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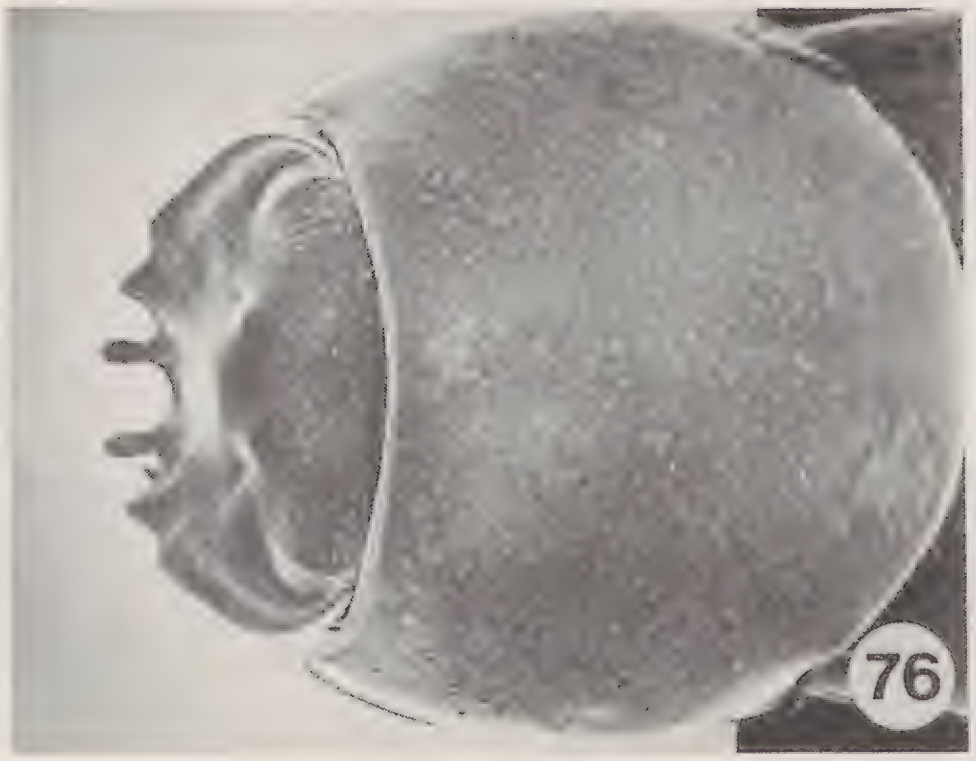
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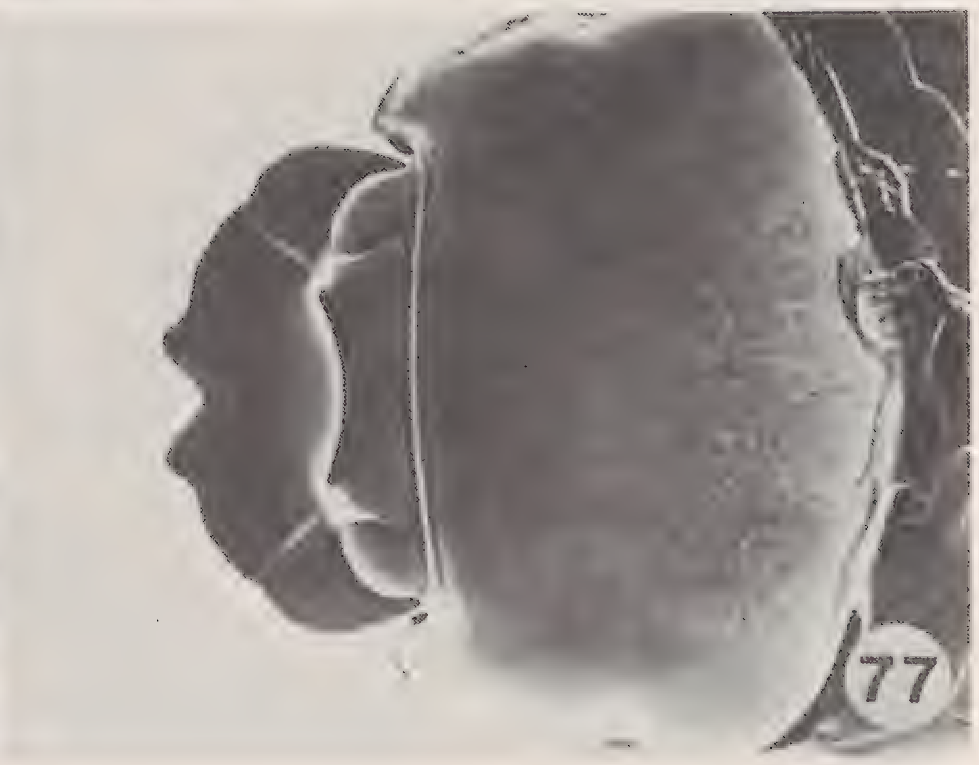
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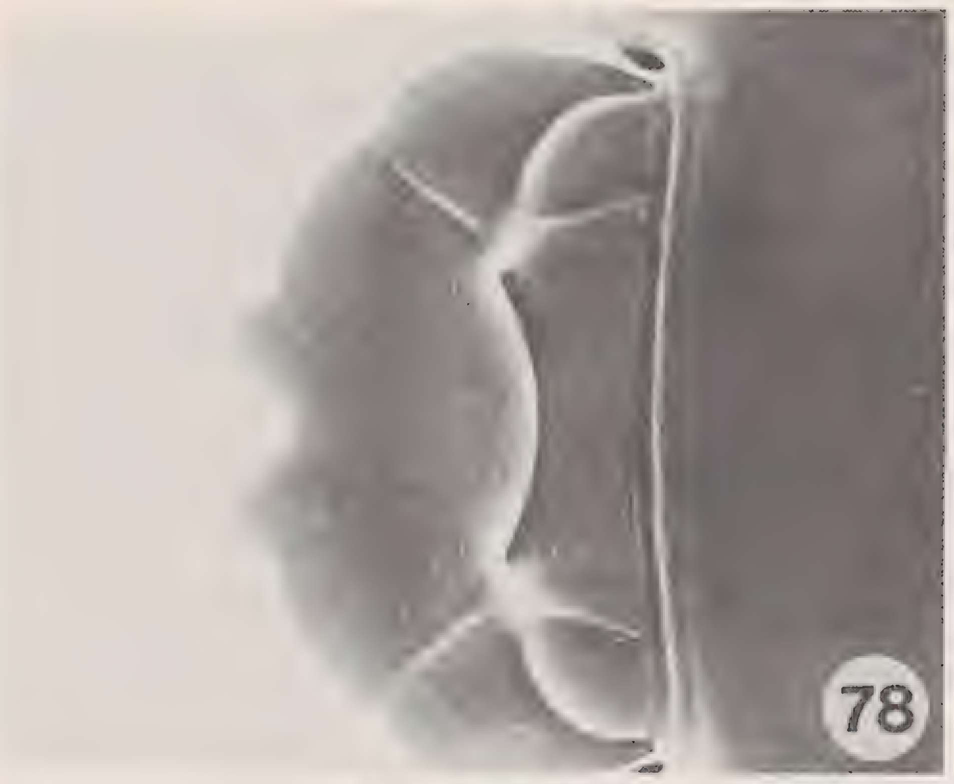
Figs. 72-74. Pedaridium bottimeri n. sp. 72. Dorsum. 73. Head. 74. Male genitalia, apical dorsal view. Figs. 75, 76. Onthocharis panamensis Paul. 75. Dorsum. 76. Head and pronotum. Fig. 77. Scatimus quadridentatus Balth., head and pronotum.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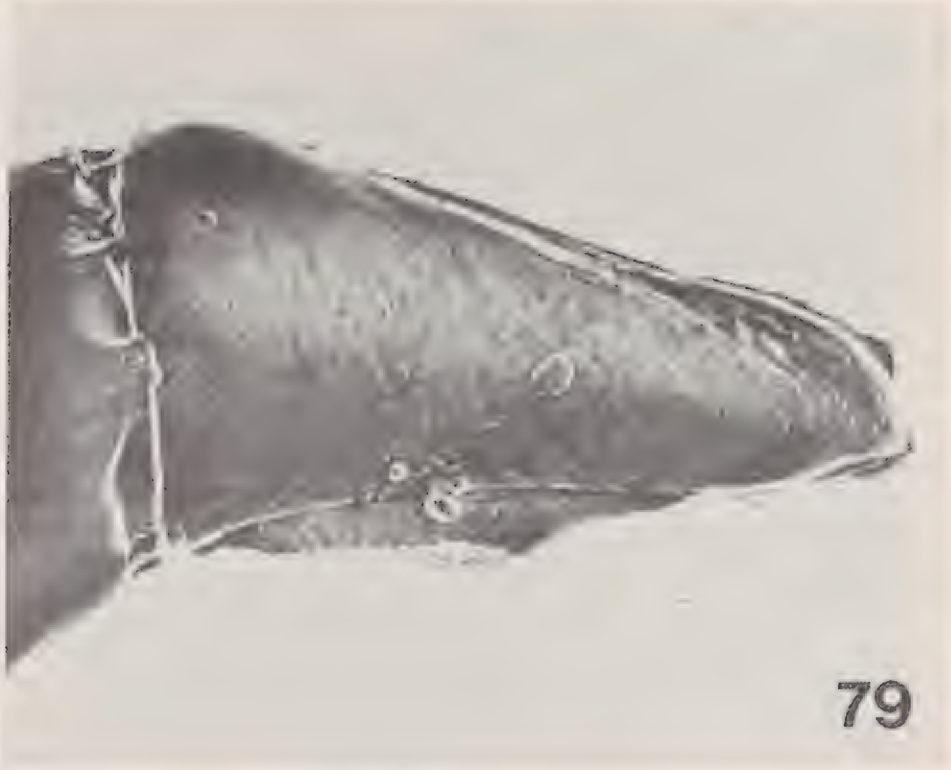
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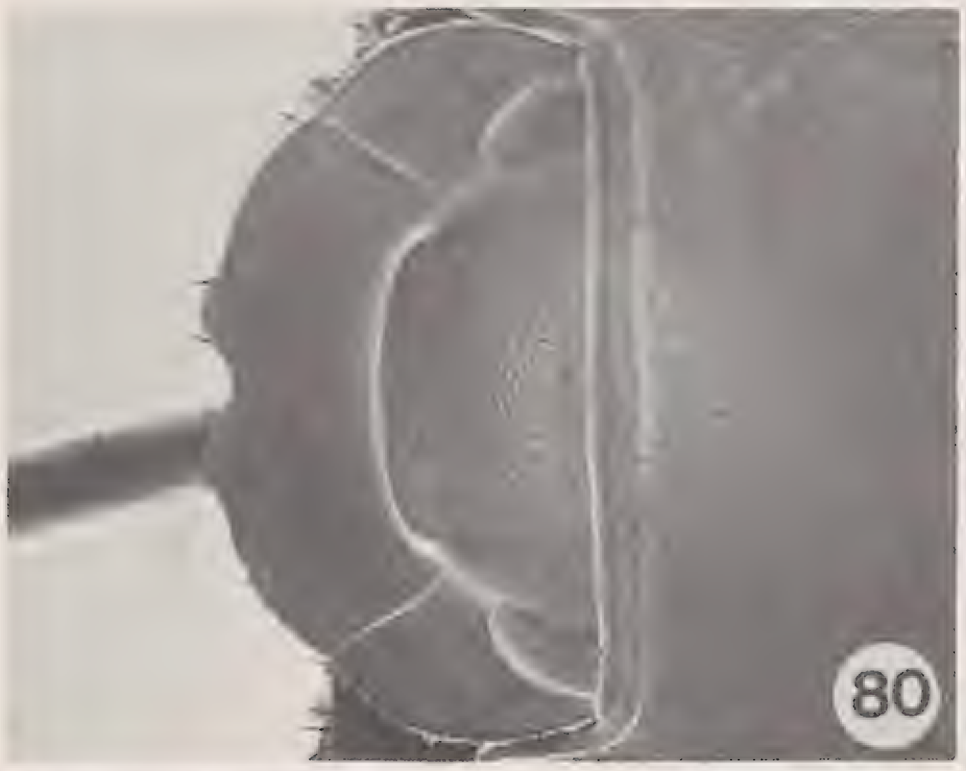
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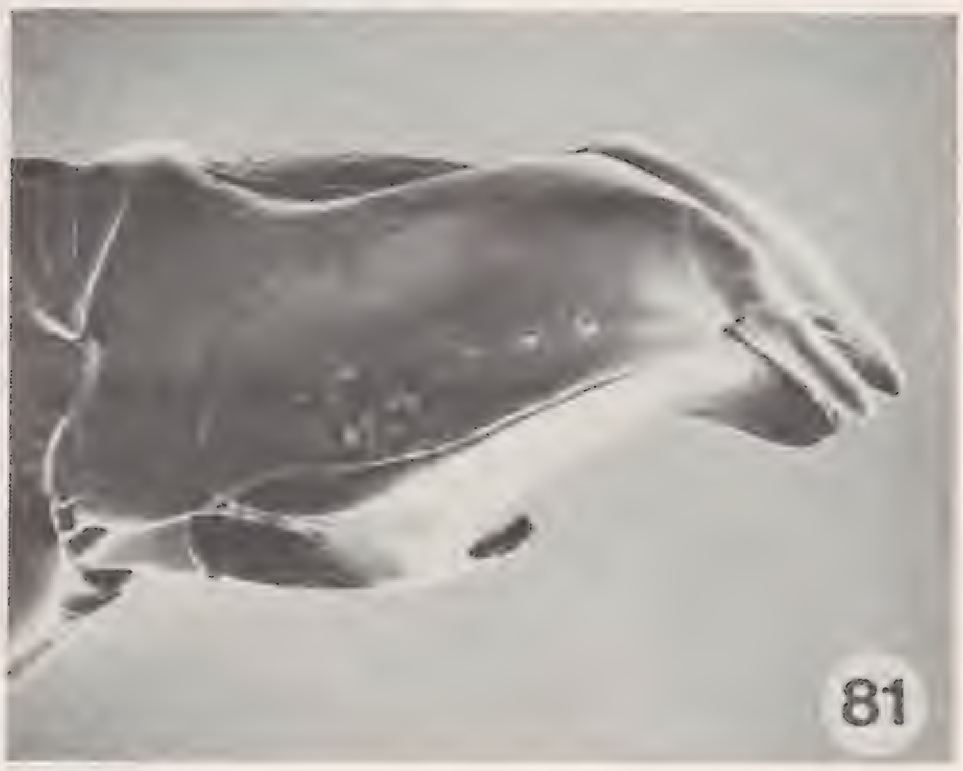
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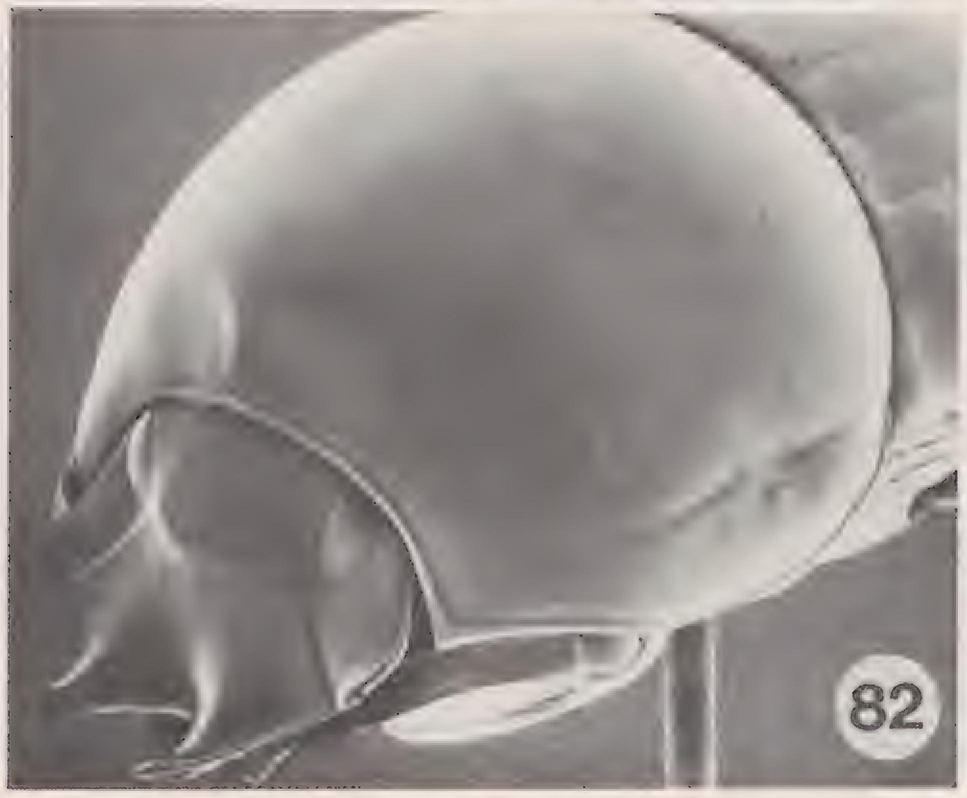
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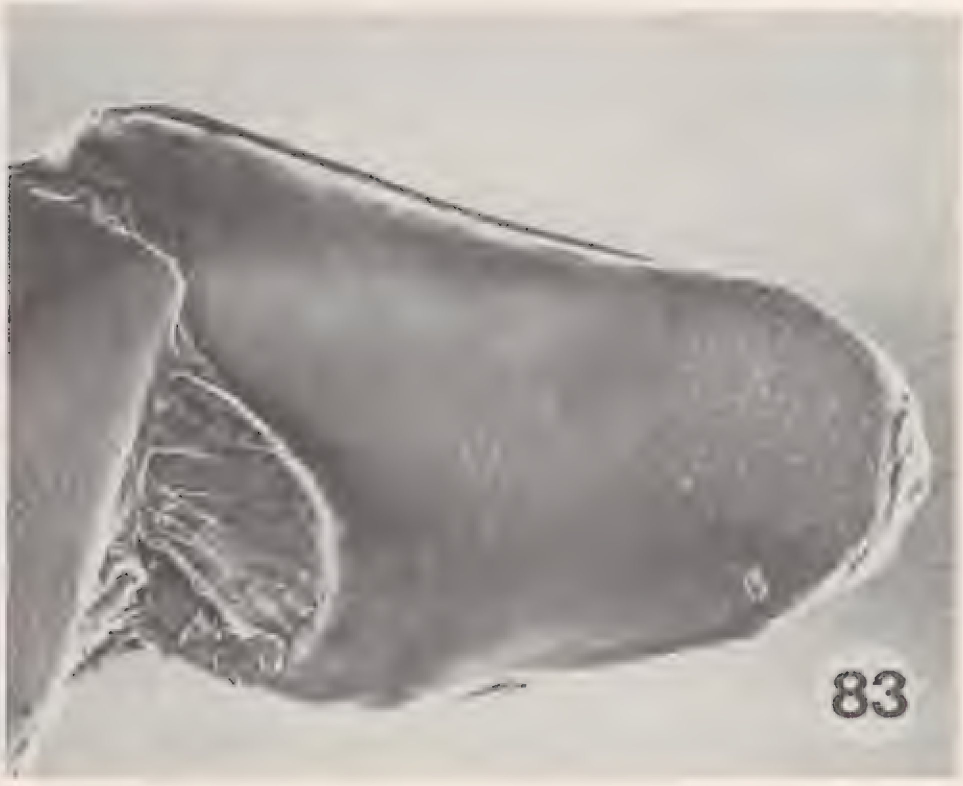
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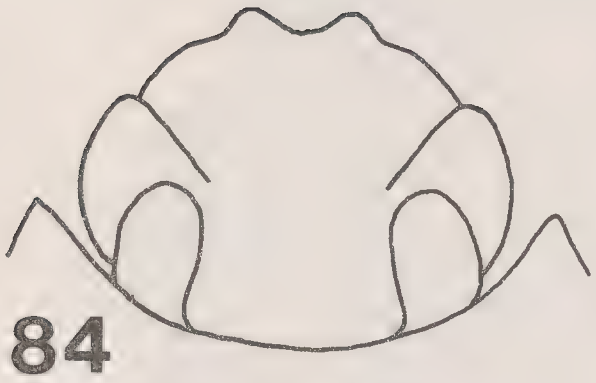
Figs. 78, 79. Scatimus quadridentatus Balth. 78. Head. 79. Male genitalia, lateral view. Figs. 80, 81. Scatimus ovatus Har. 80. Head. 81. Male genitalia, lateral view. Figs. 82, 83. Uroxys gorgon Arrow. 82. Head and pronotum. 83. Male genitalia, lateral view.



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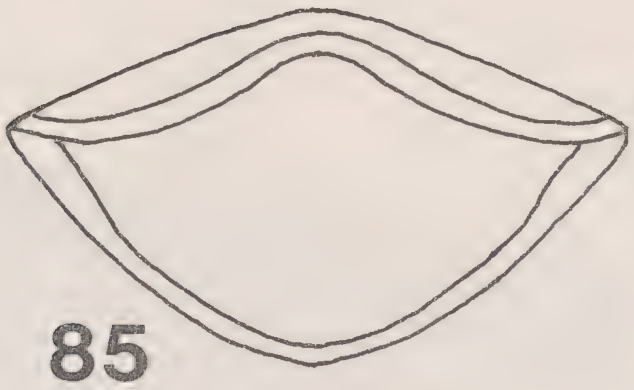

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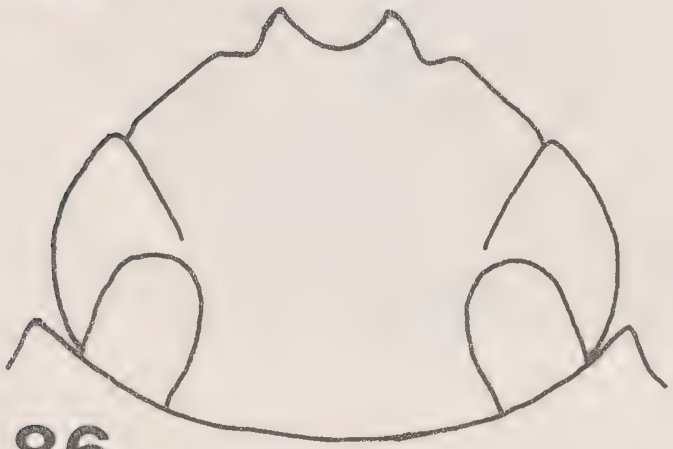

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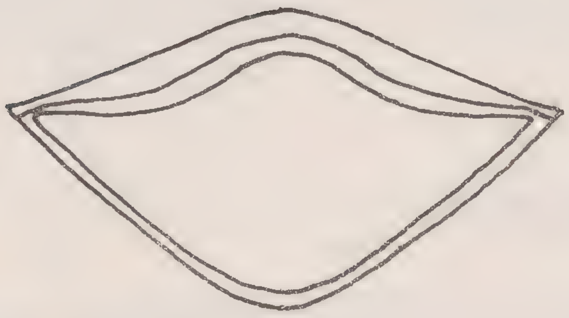

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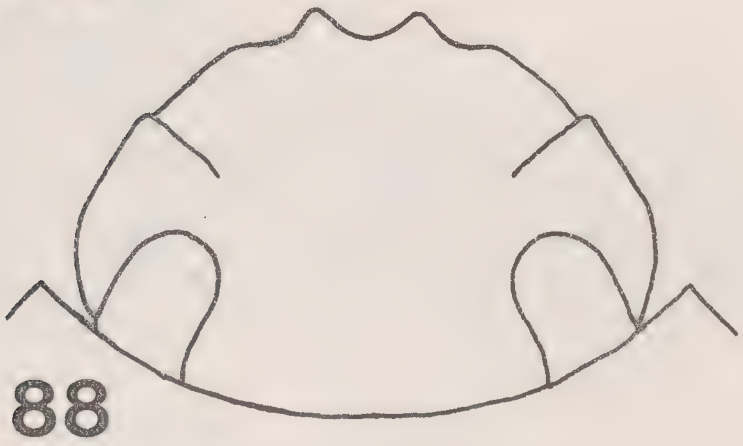

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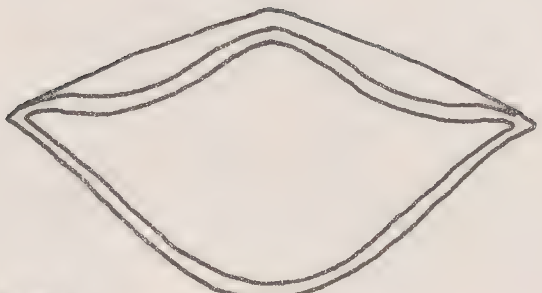

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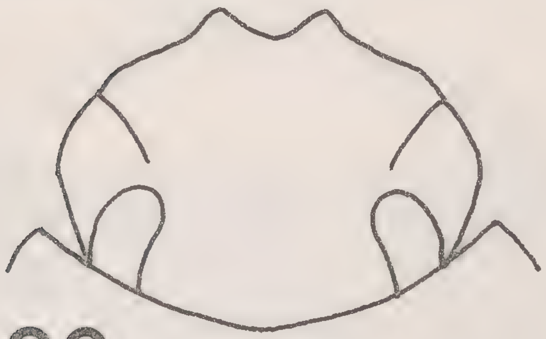

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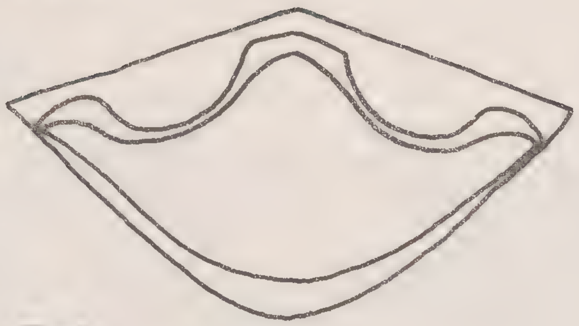

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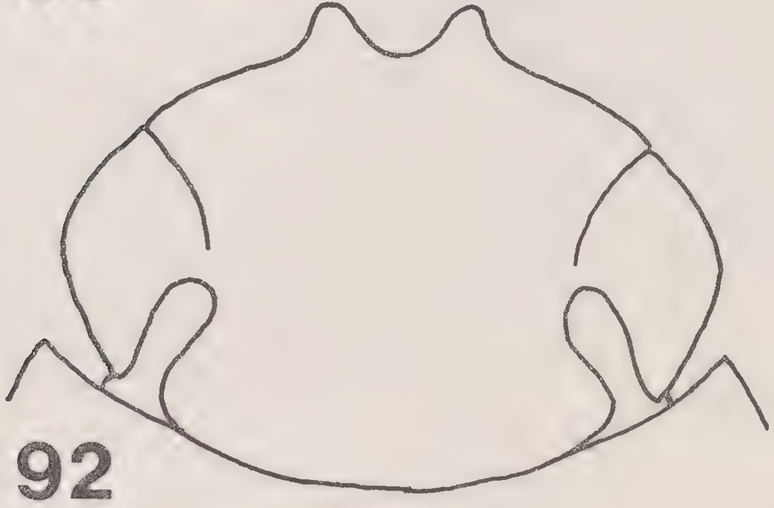

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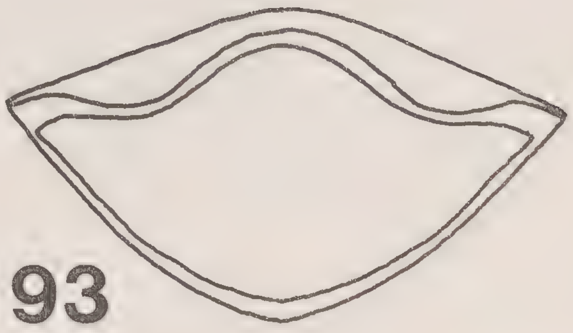

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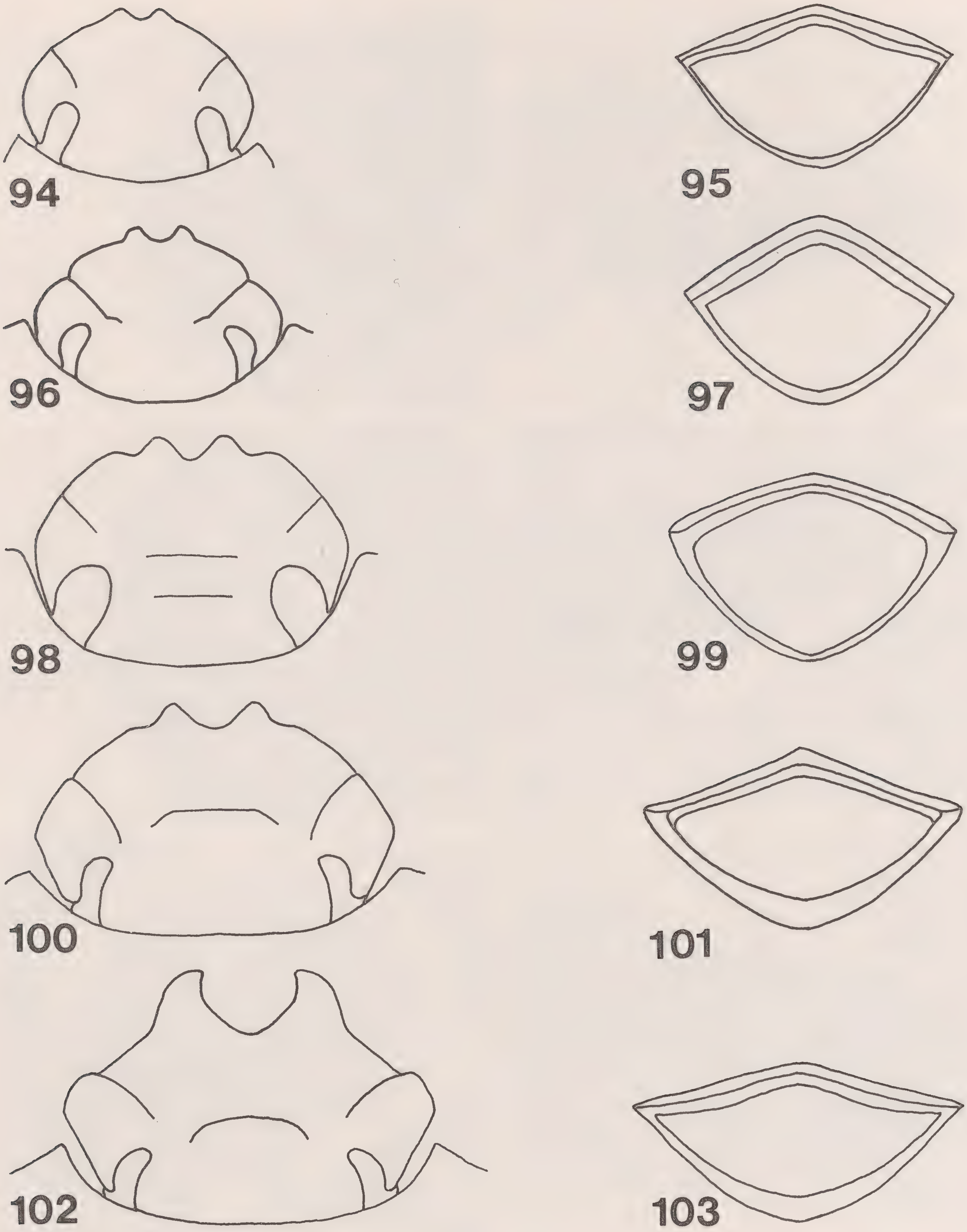
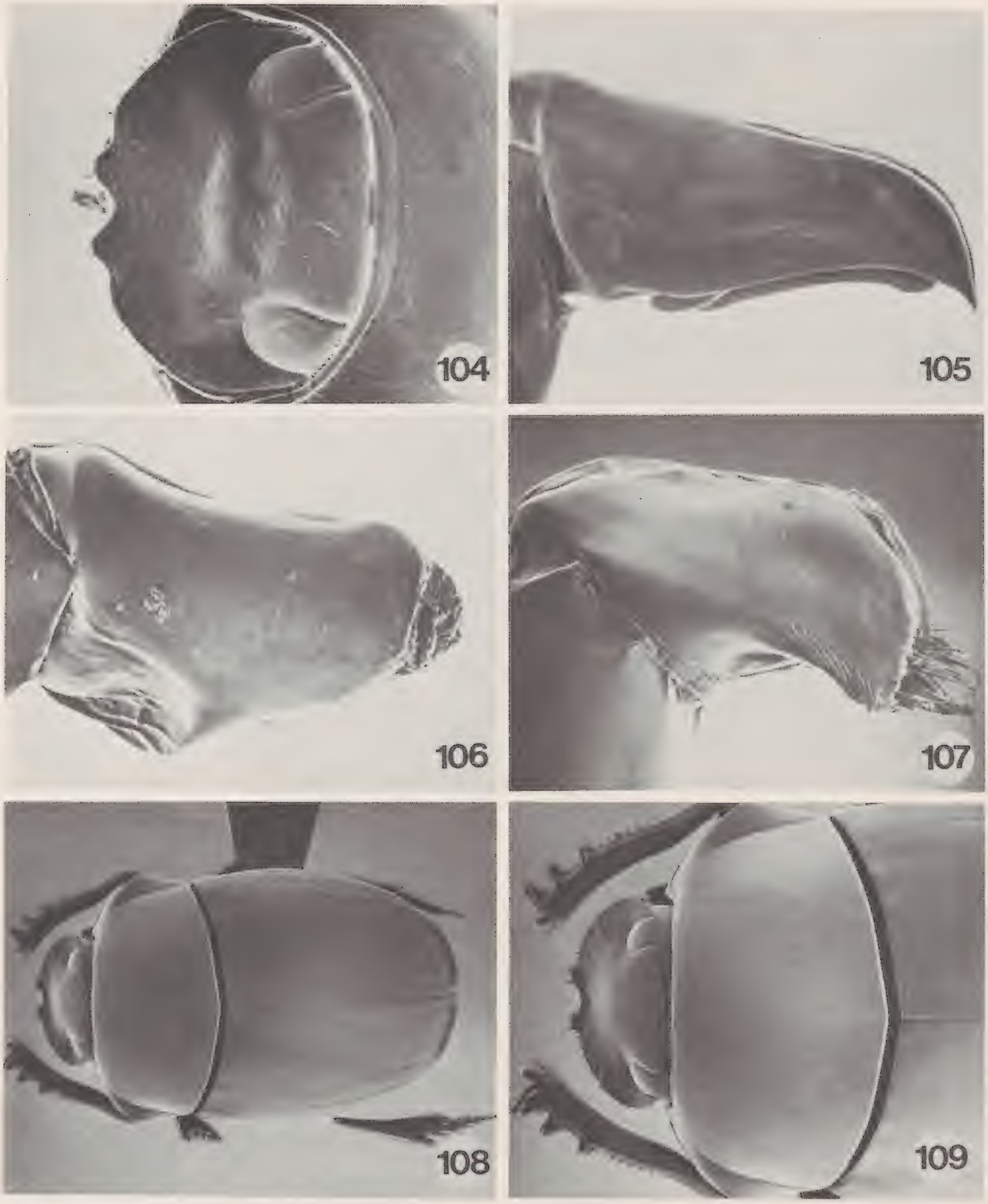
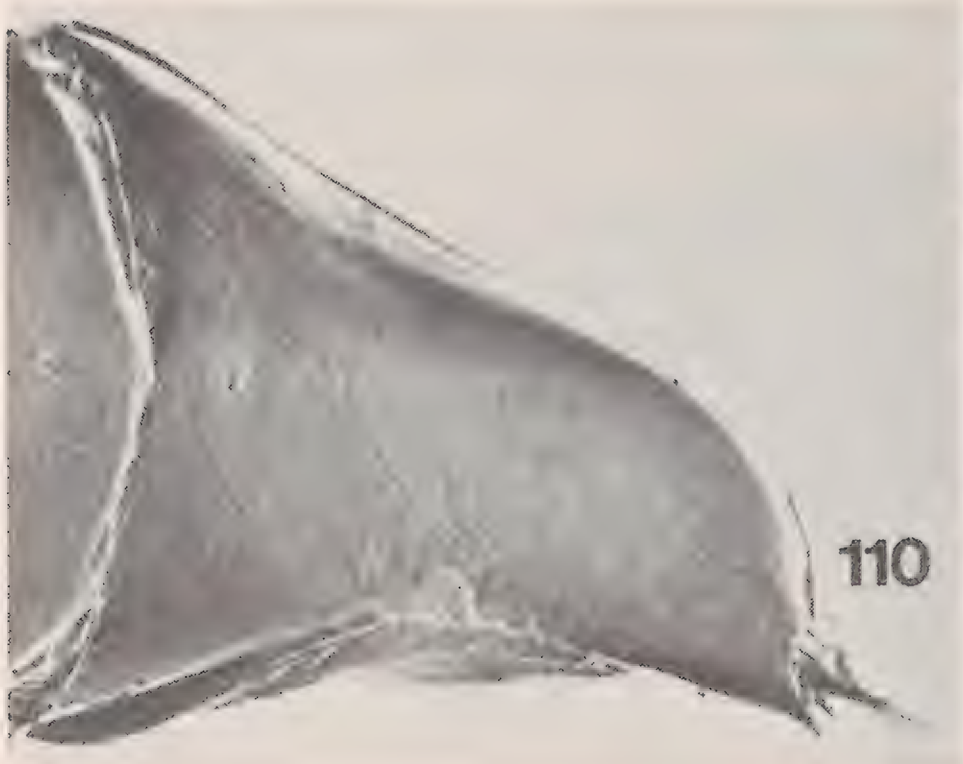
Figs. 84-93. Uroxys spp., head and pygidium respectively. 84, 85. platypyga n. sp. 86, 87. macrocularis n. sp. 88, 89. bidentis n. sp. 90, 91. micros Bates. 92, 93. microcularis n. sp.



Figs. 94-103. Uroxys spp., head and pygidium respectively. 94, 95. gatunensis n. sp. 96, 97. dybasi n. sp. 98, 99. depressifrons n. sp. 100, 101. metagorgon n. sp. 102, 103. gorgon Arrow.



Figs. 104–109. *Uroxys* spp. 104. *depressifrons* n. sp., head. 105. *depressifrons* n. sp., male genitalia, lateral view. 106. *metagorgon* n. sp., male genitalia, lateral view. 107. *platypyga* n. sp., male genitalia, lateral view. 108, 109. *micros* Bates. 108. Dorsum. 109. Head and pronotum.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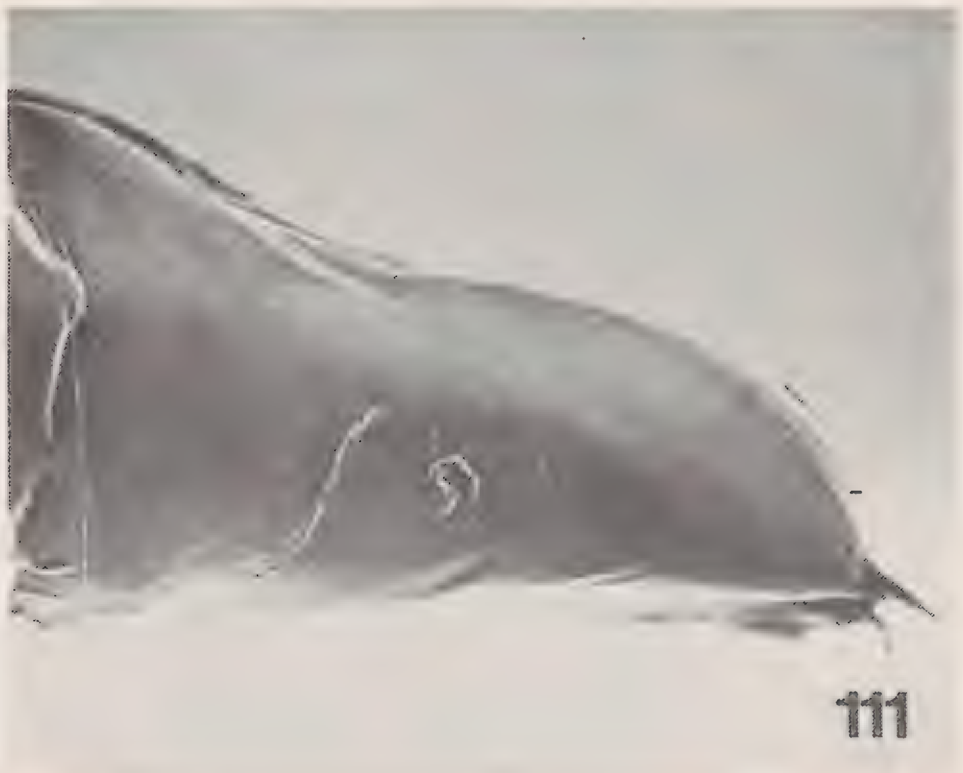
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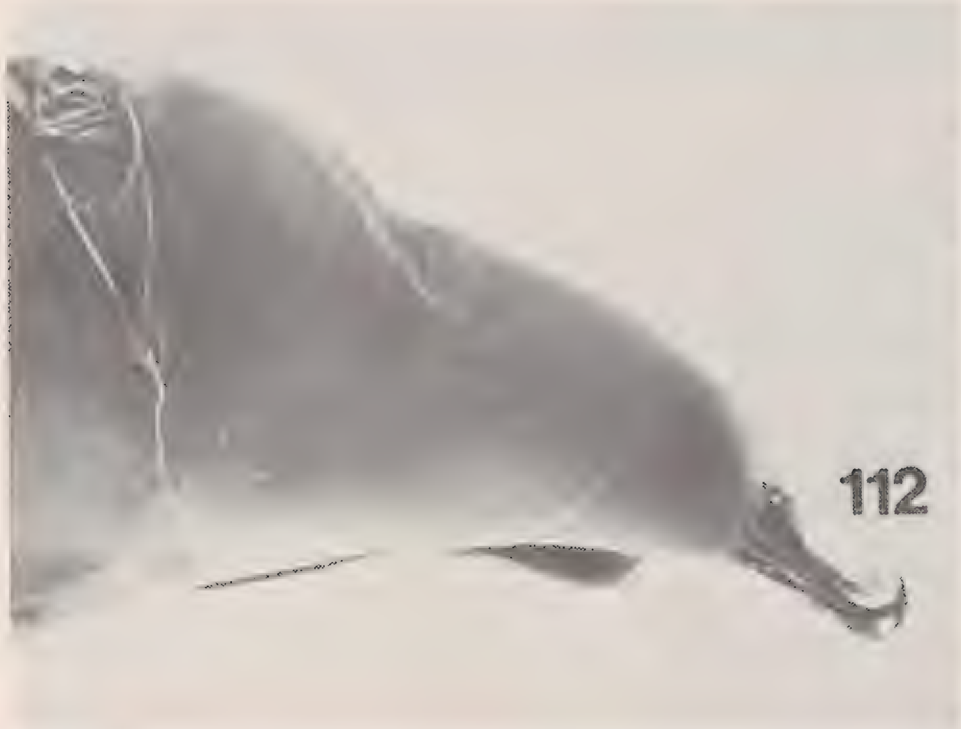
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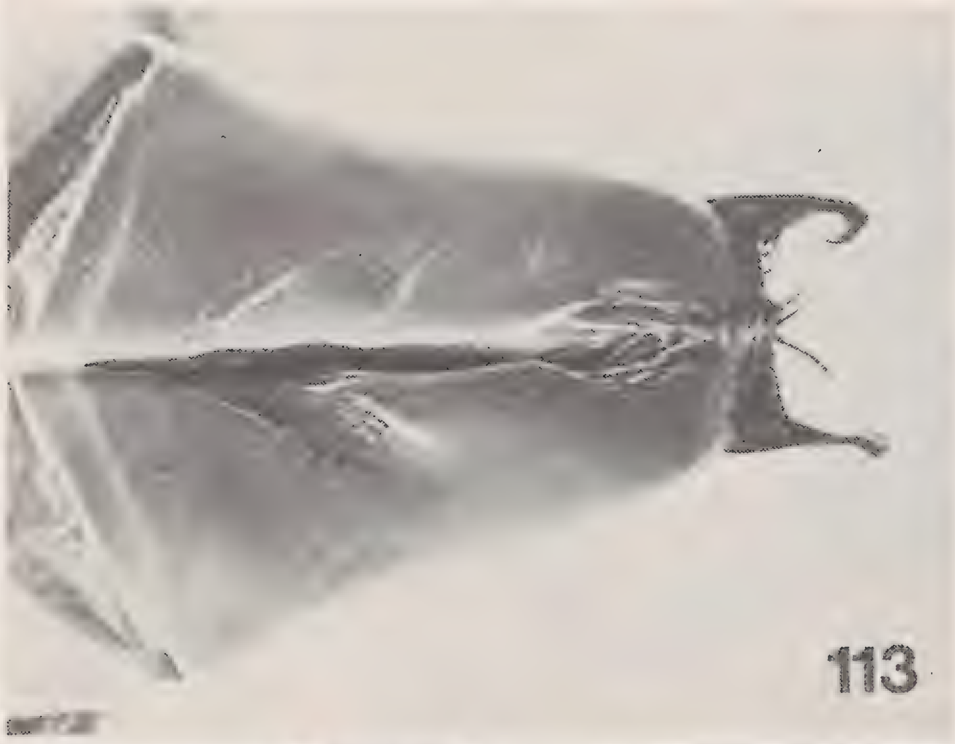
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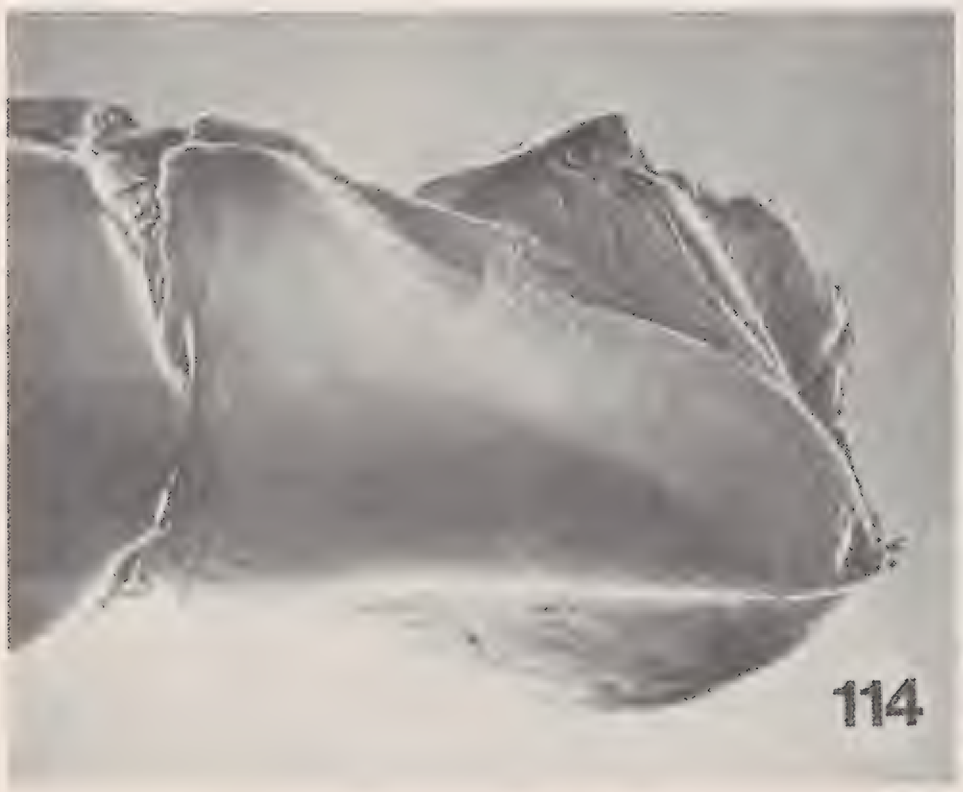
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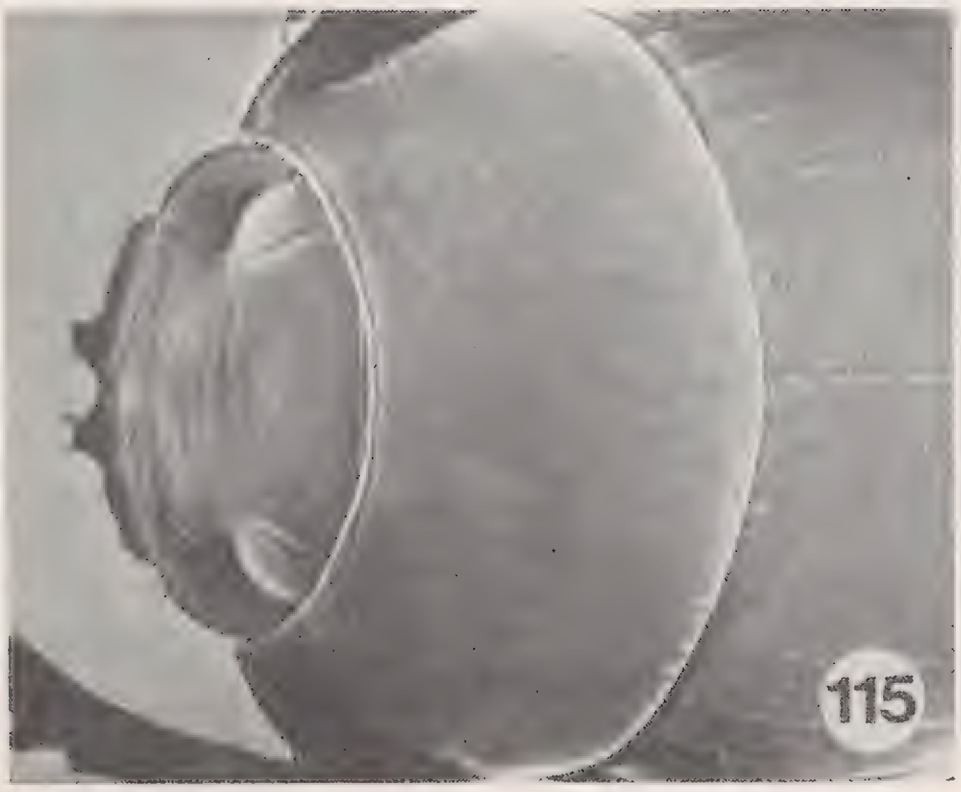
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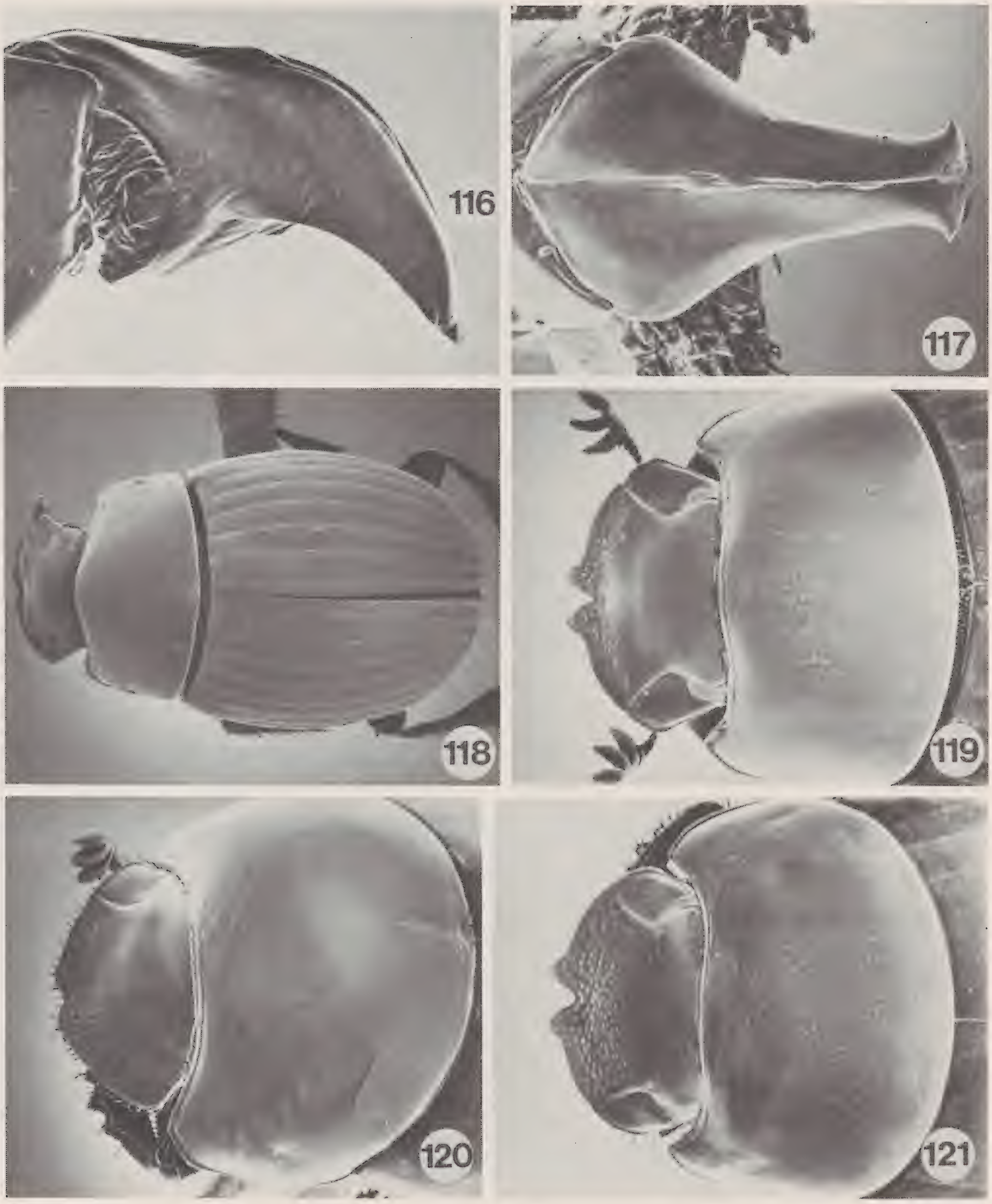
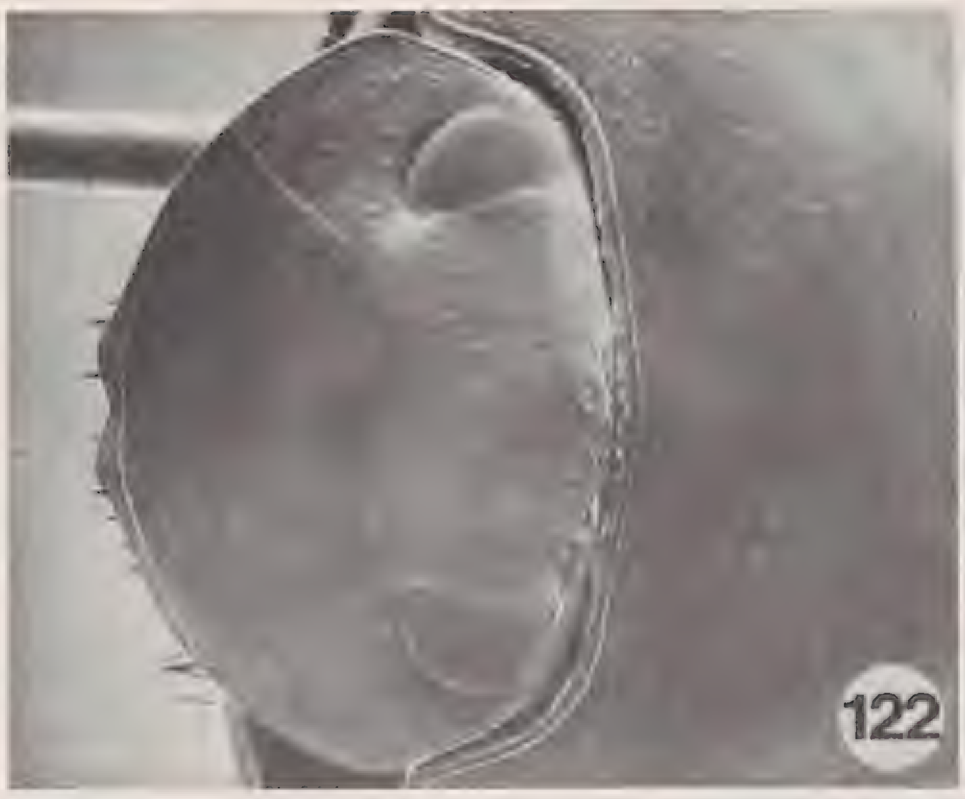
Figs. 110-114. *Uroxys* spp., male genitalia. 110. *micros* Bates, lateral view. 111. *bidentis* n. sp., lateral view. 112. *microcularis* n. sp., lateral view. 113. *microcularis* n. sp., dorsal view. 114. *macrocularis* n. sp., lateral view. 115. *dybasi* n. sp., head and pronotum.



Figs. 116, 117. *Uroxys dybasi* n. sp., male genitalia. 116. Lateral view. 117. Dorsal view. Figs. 118–121. *Ateuchus* spp. 118. *candezei* (Har.), dorsum. 119. *candezei* (Har.), head and pronotum. 120. *aeneomicans* (Har.), head and pronotum. 121. *guatemalensis* (Bates), head and pronotum.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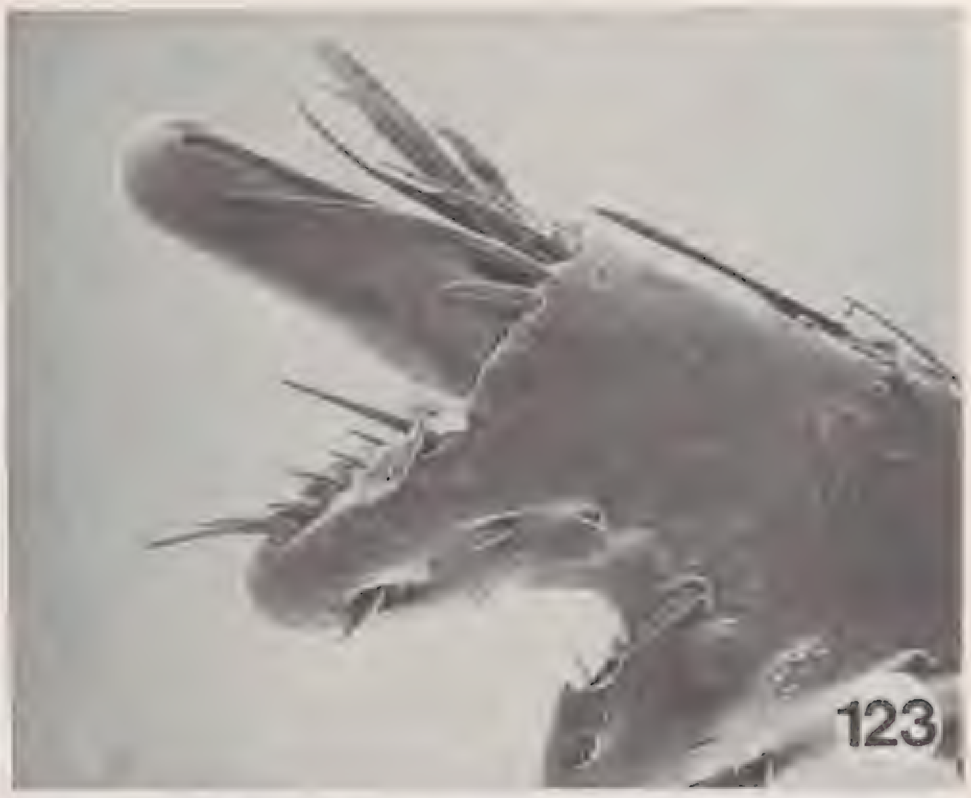
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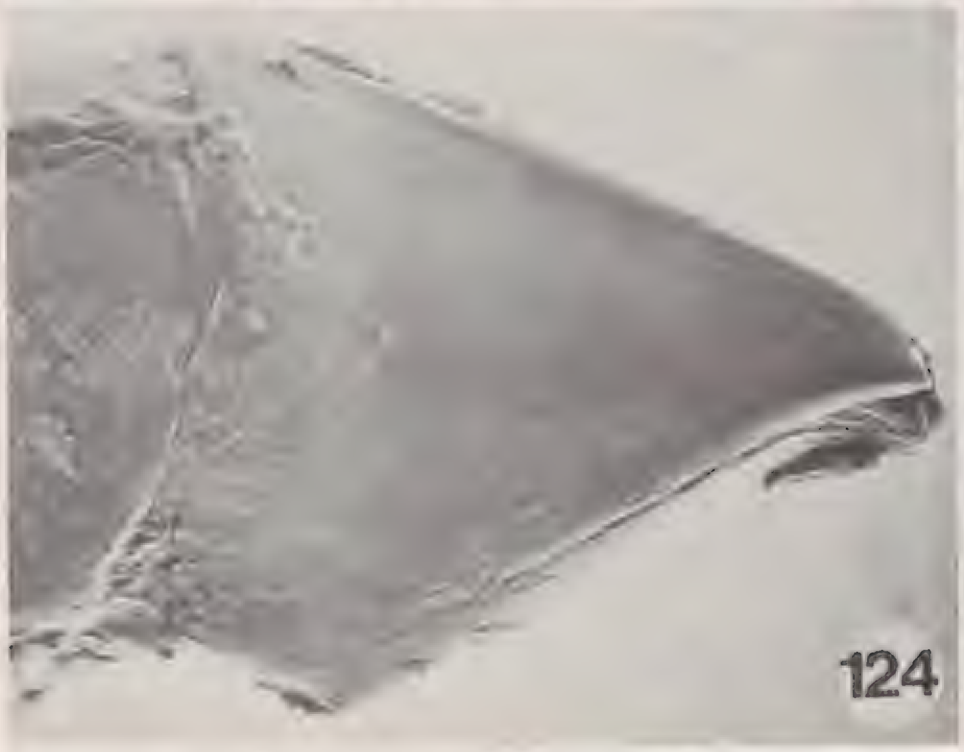
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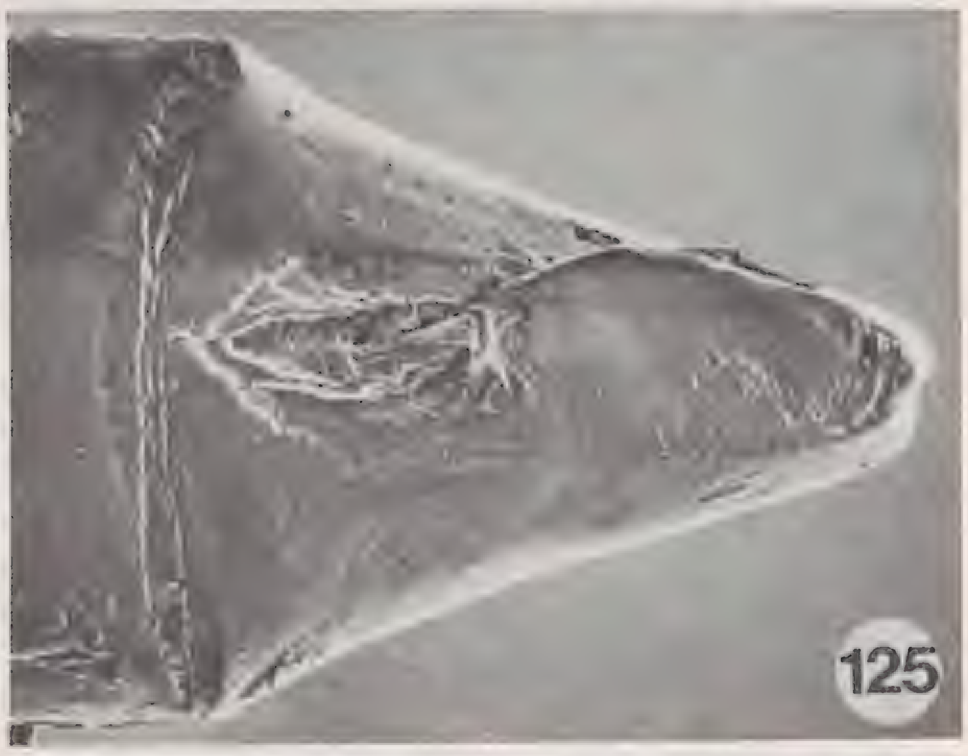
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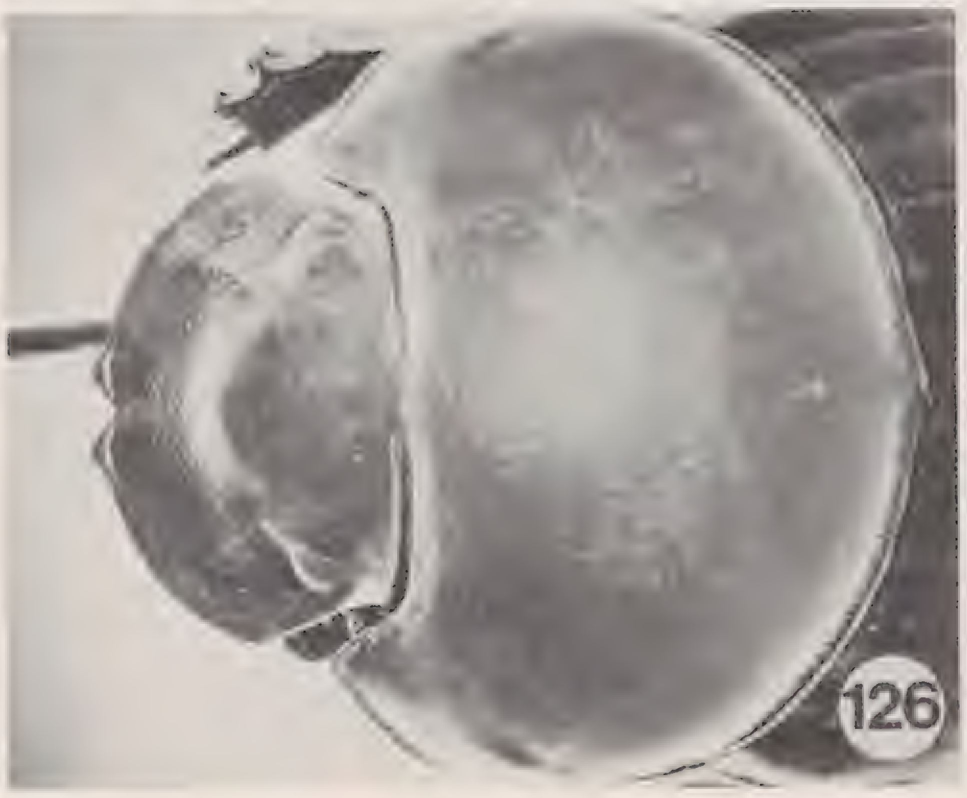
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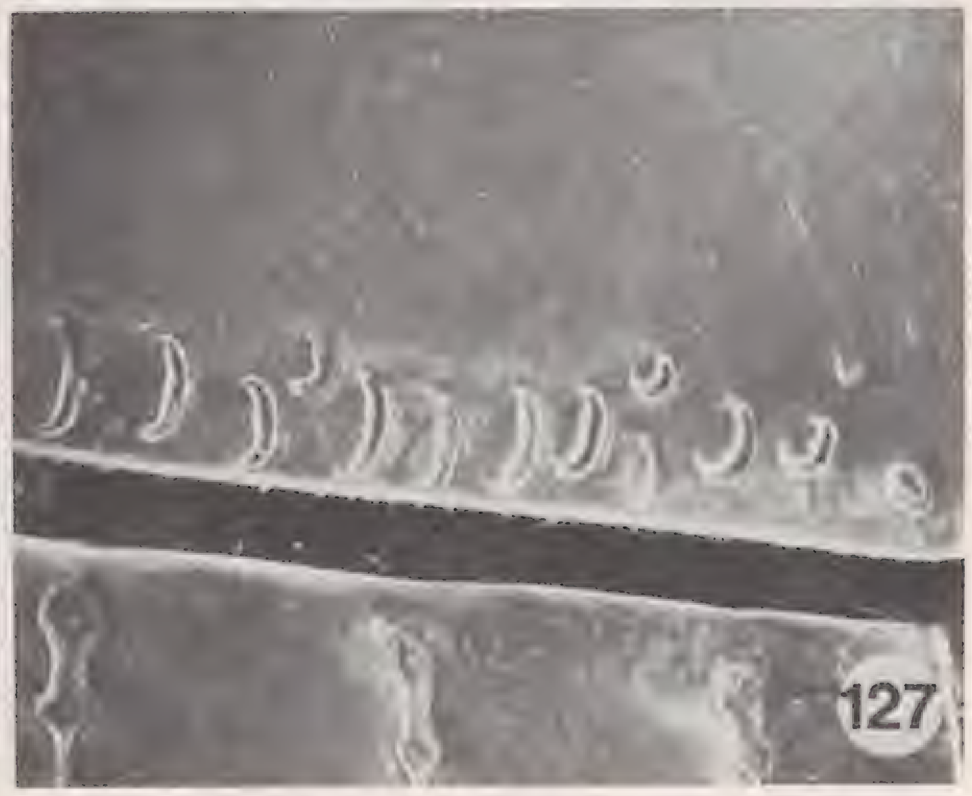
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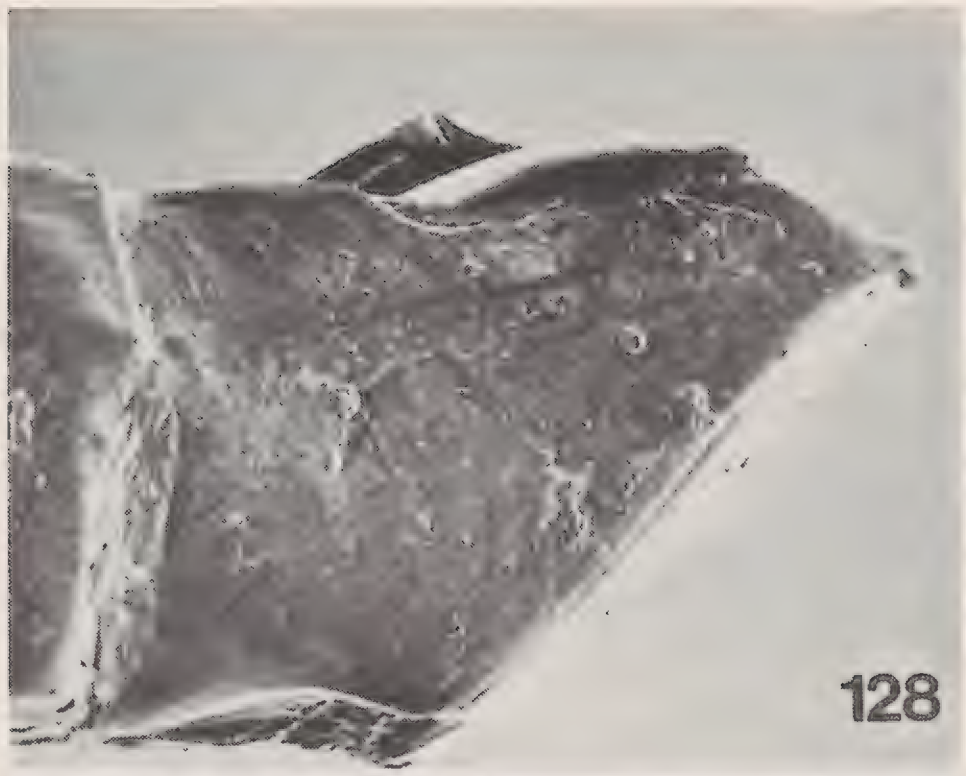
Figs. 122-125. Canthidium centrale Bouc. 122. Head. 123. Apex, male fore tibia. 124. Male genitalia, lateral view. 125. Male genitalia, dorsal view. Figs. 126, 127. Canthidium tuberifrons n. sp. 126. Head and pronotum. 127. Posterior margin of pronotum.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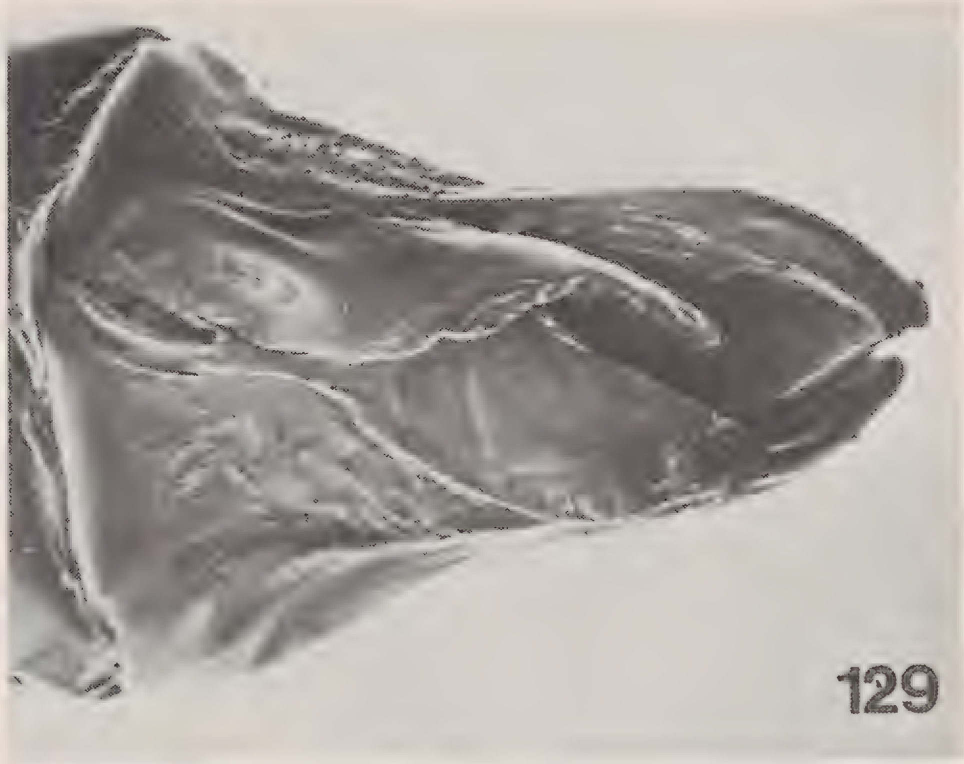
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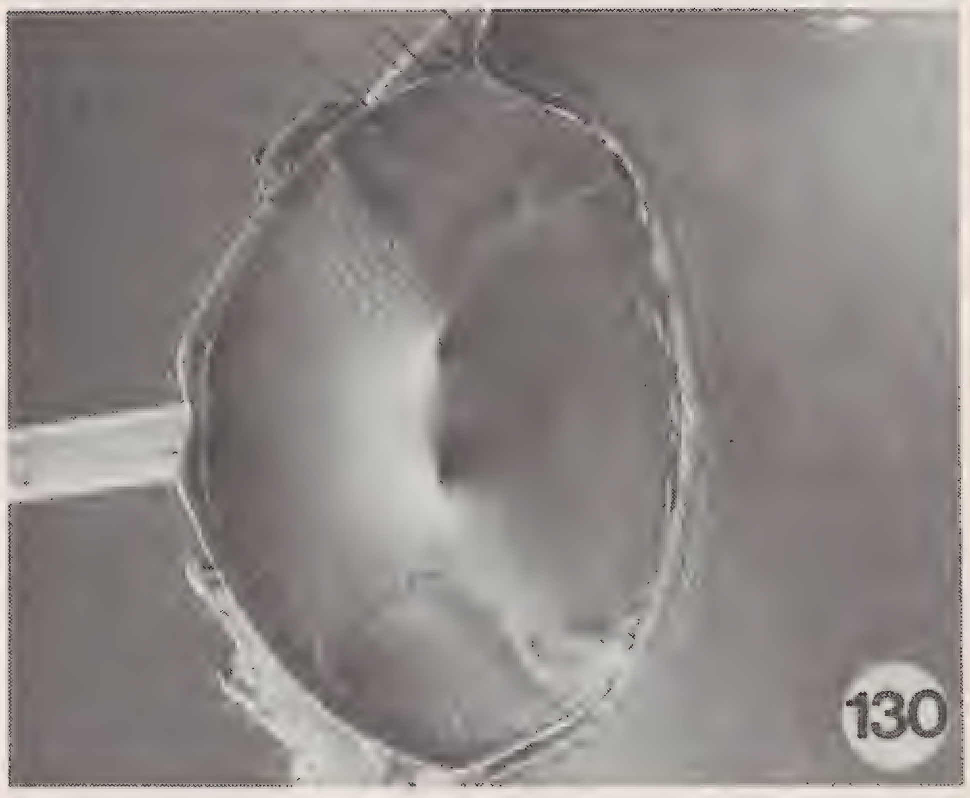
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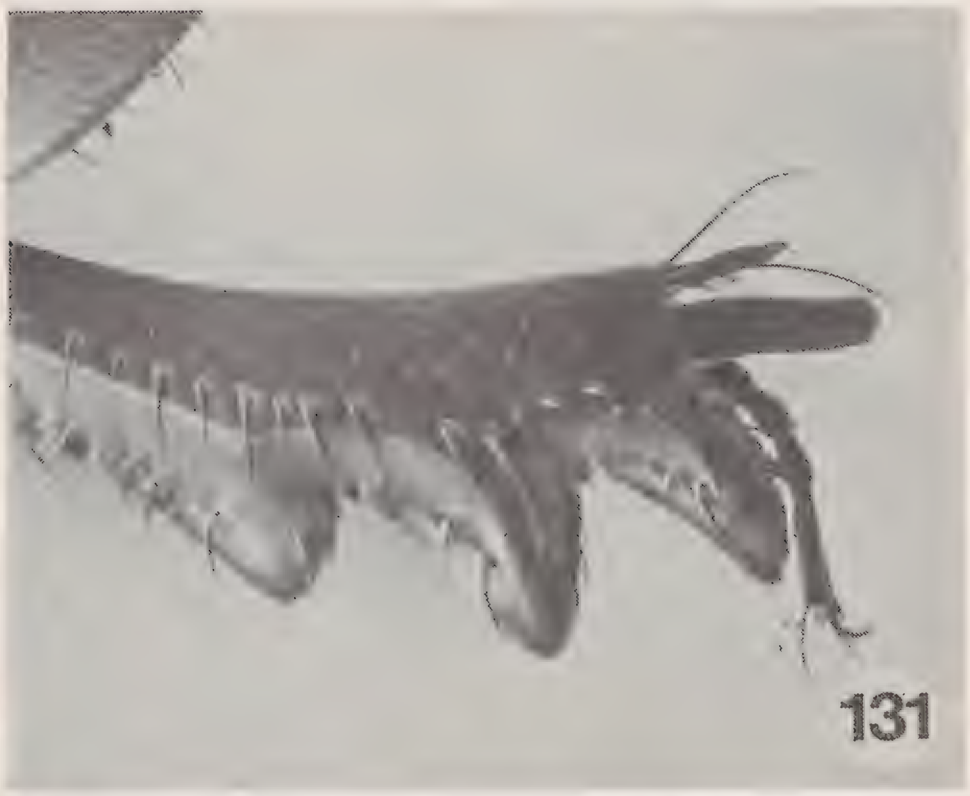
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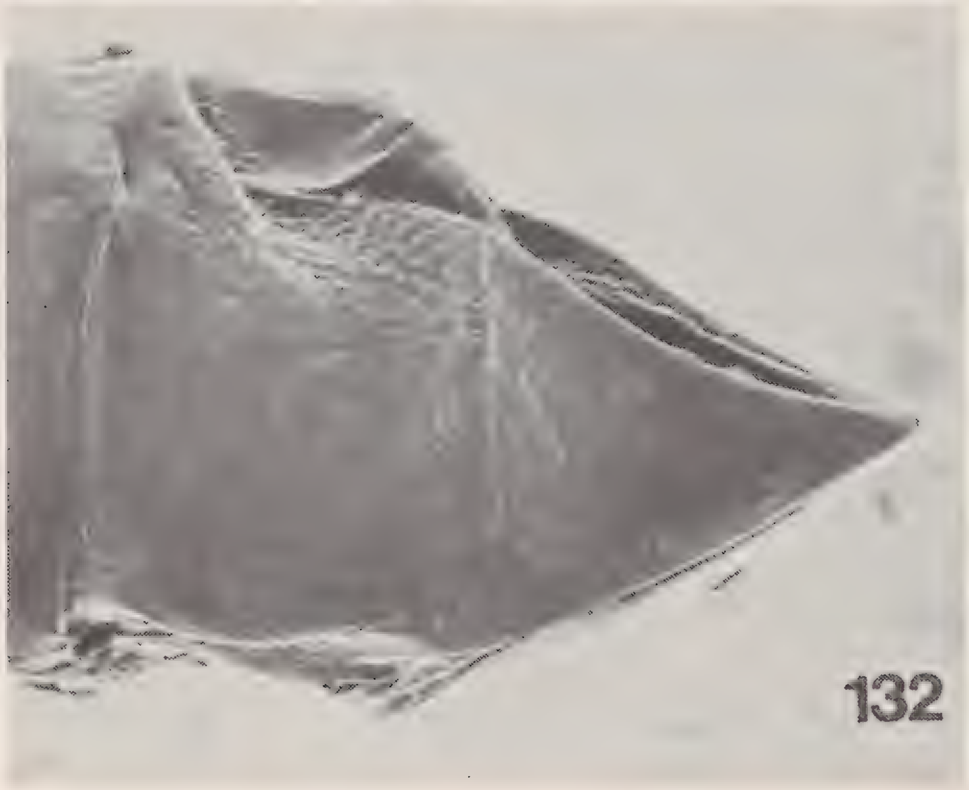
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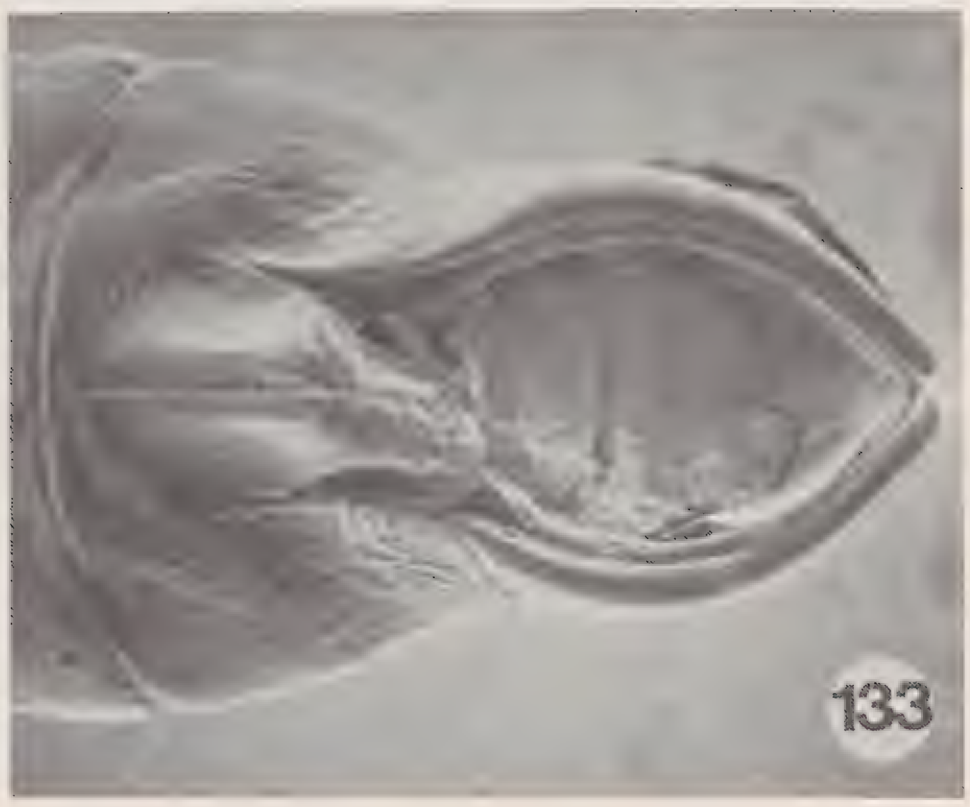
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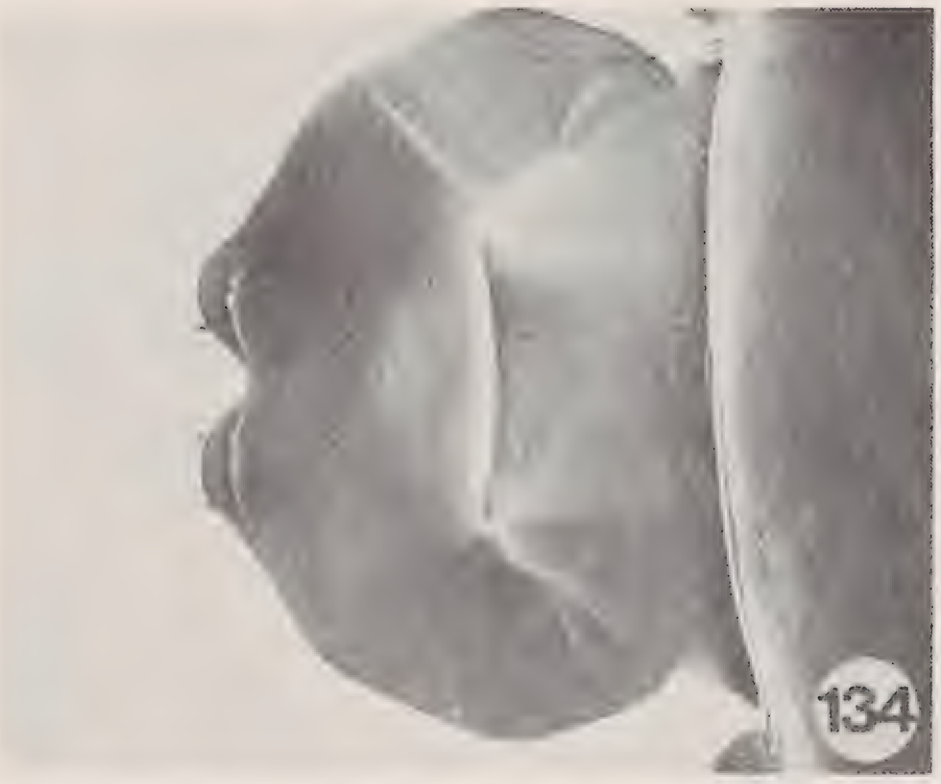
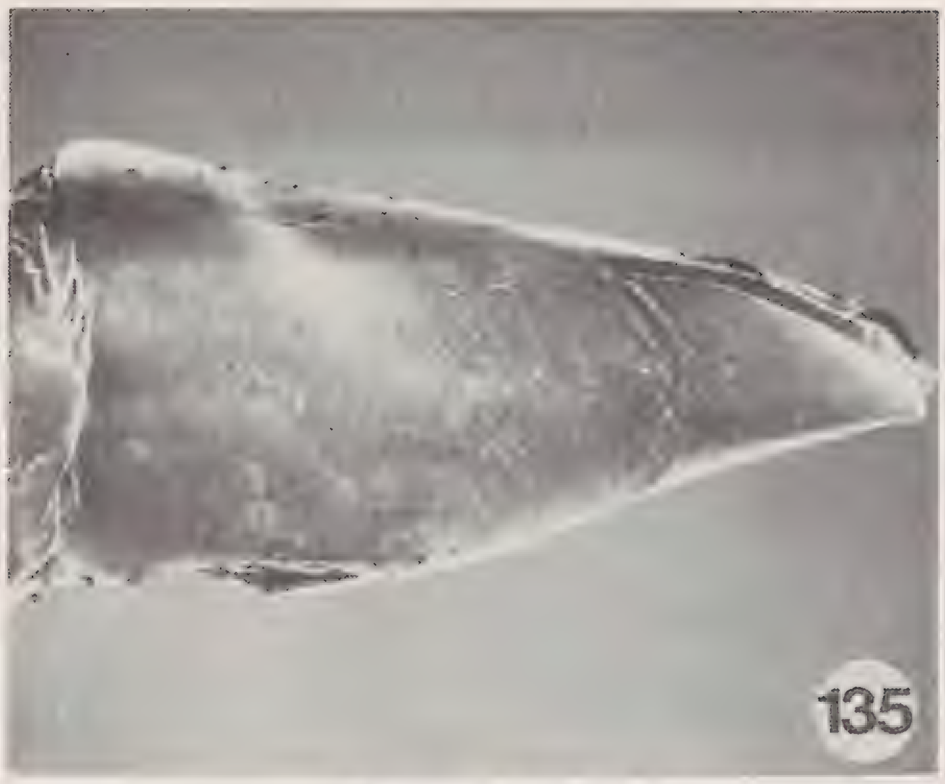
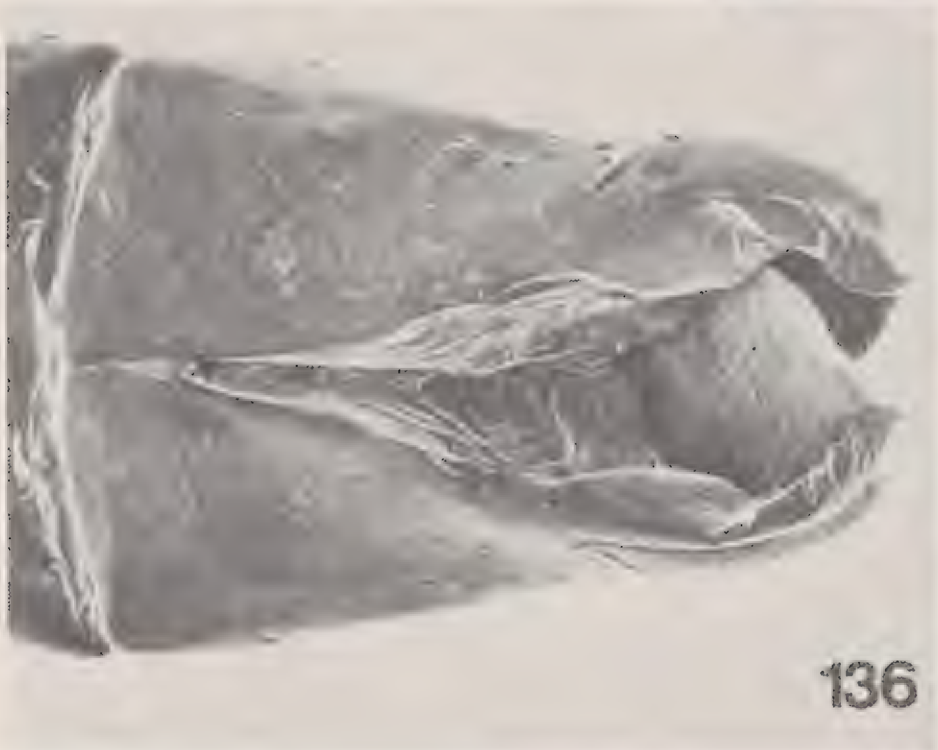
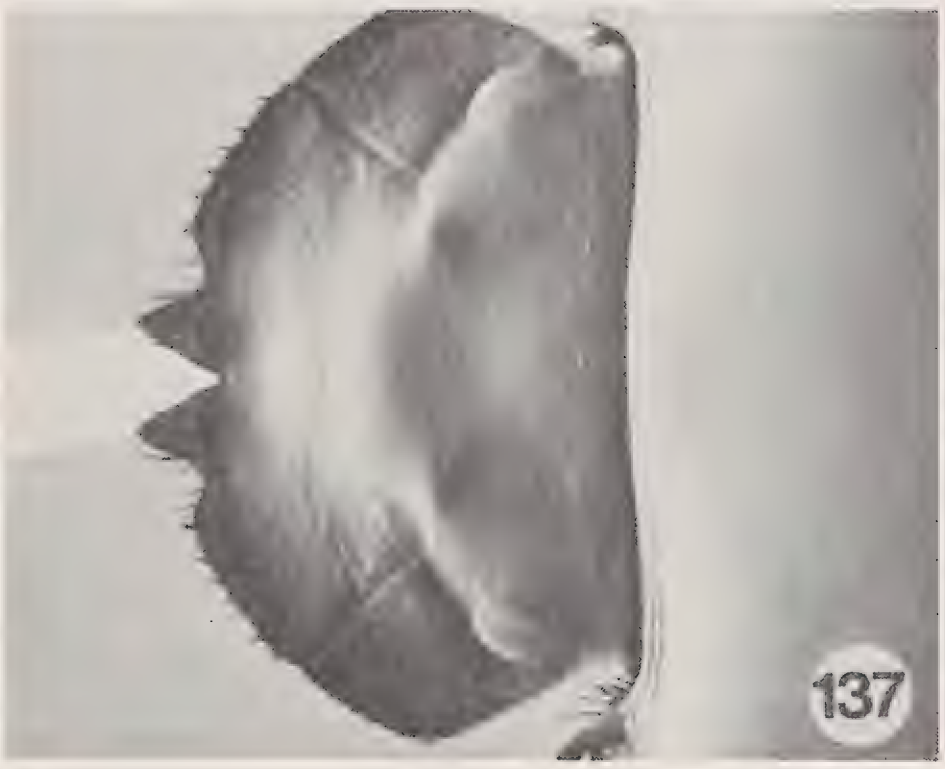
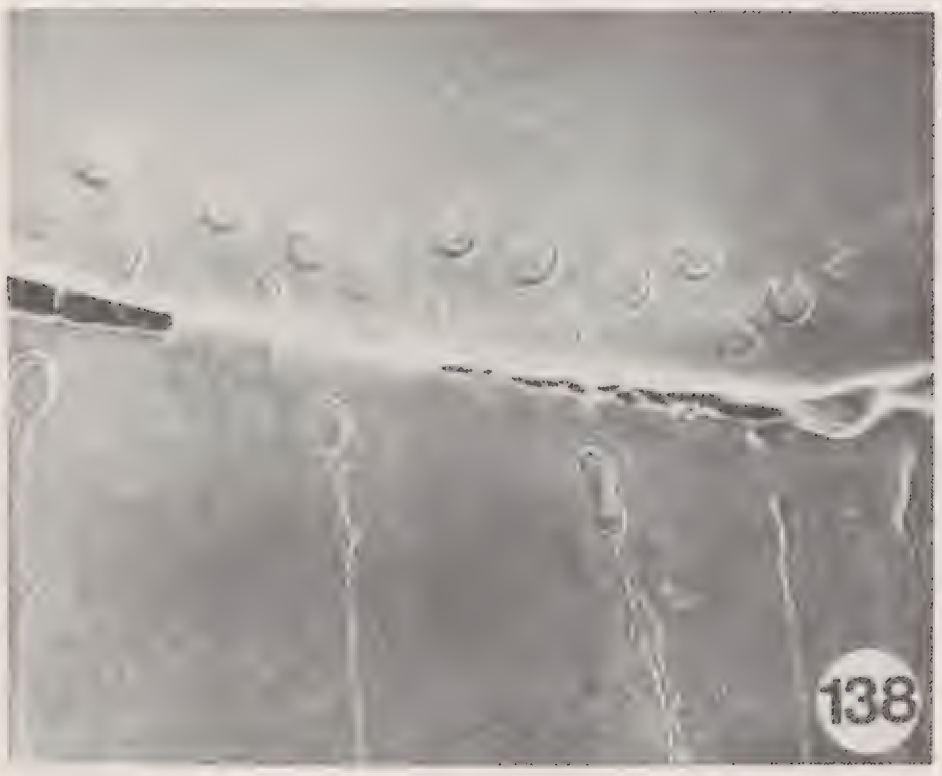
Figs. 128, 129. *Canthidium tuberifrons* n. sp., male genitalia. 128. Lateral view. 129. Dorsal view. Figs. 130-133. *Canthidium haroldi* Preud. 130. Head. 131. Male fore tibia. 132. Male genitalia, lateral view. 133. Male genitalia, dorsal view.

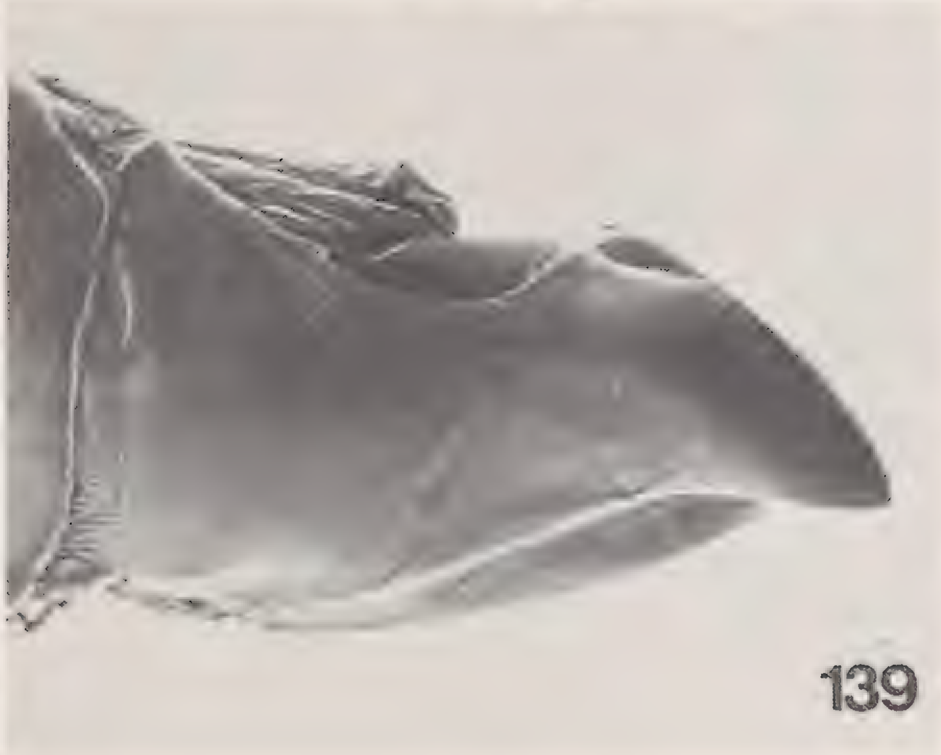




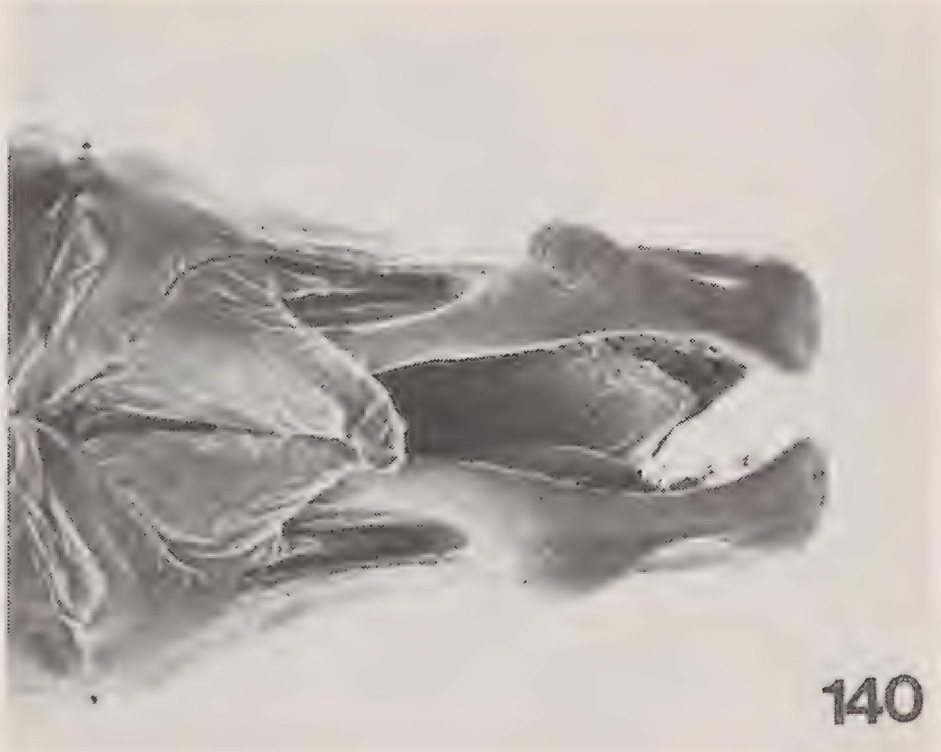








Figs. 134-136. Canthidium angusticeps Bates. 134. Head. 135. Male genitalia, lateral view. 136. Male genitalia, dorsal view. Figs. 137-139. Canthidium elegantulum Balth. 137. Head. 138. Posterior margin of pronotum. 139. Male genitalia, lateral view.



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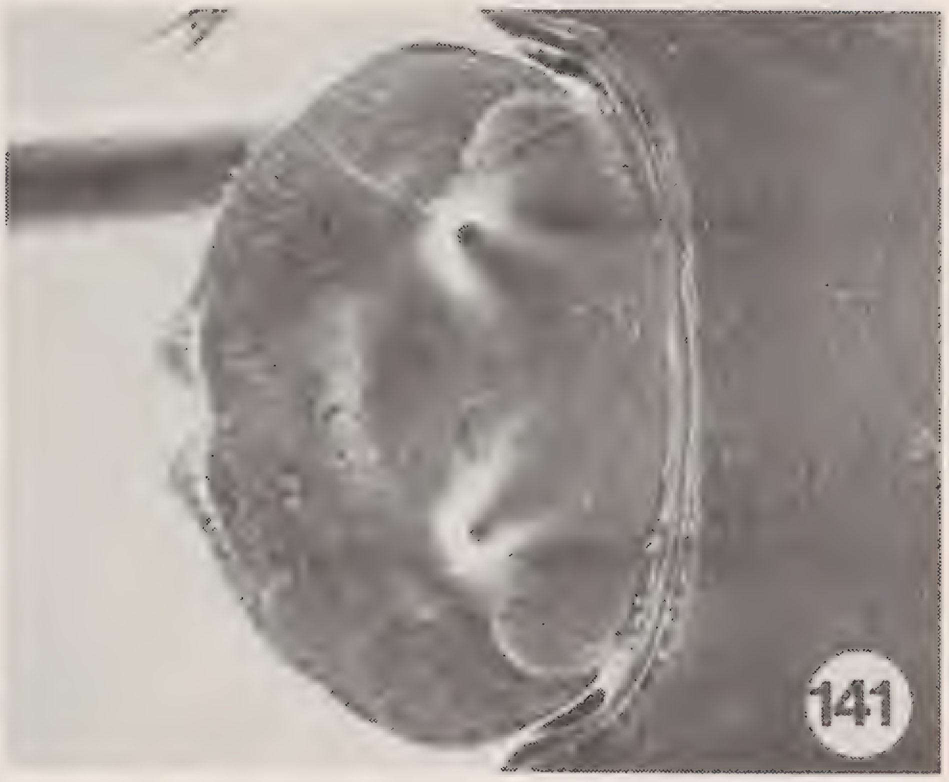

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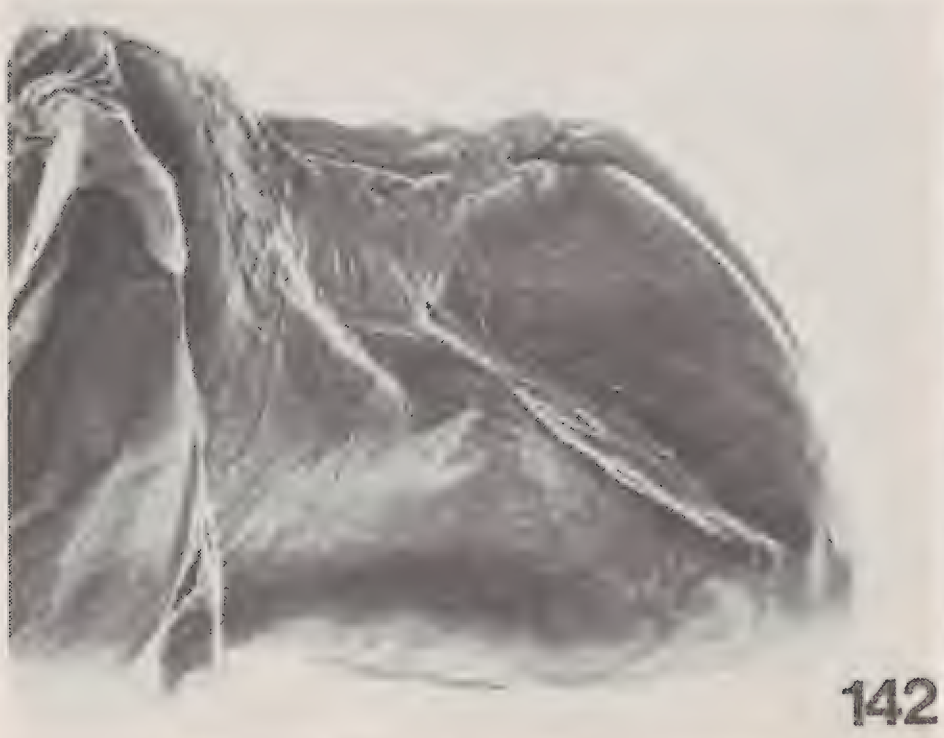

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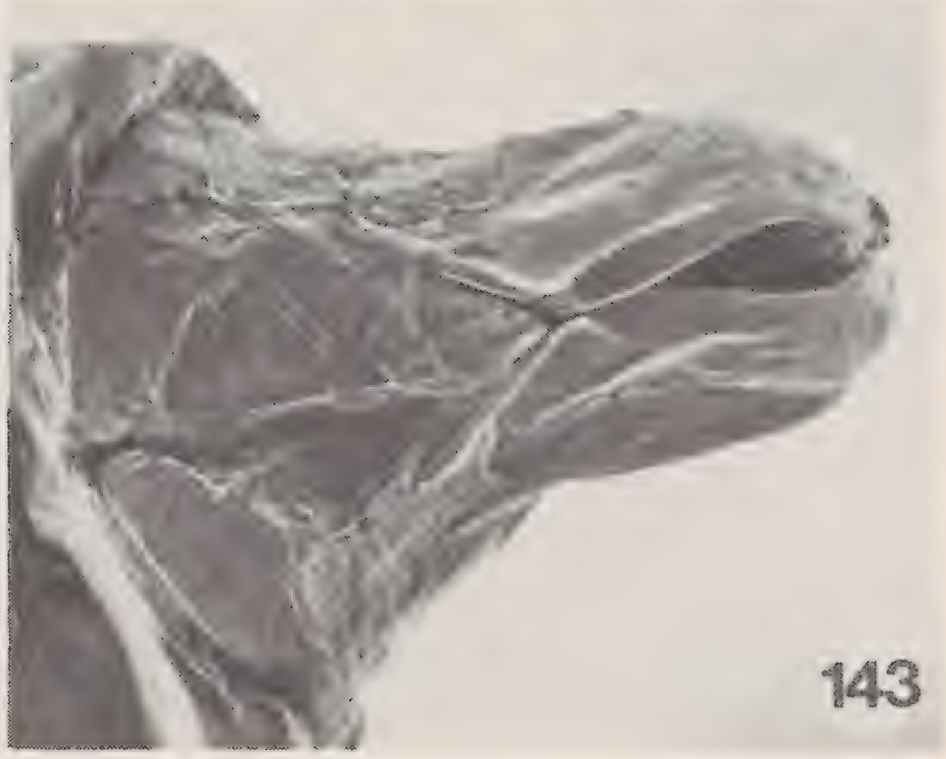

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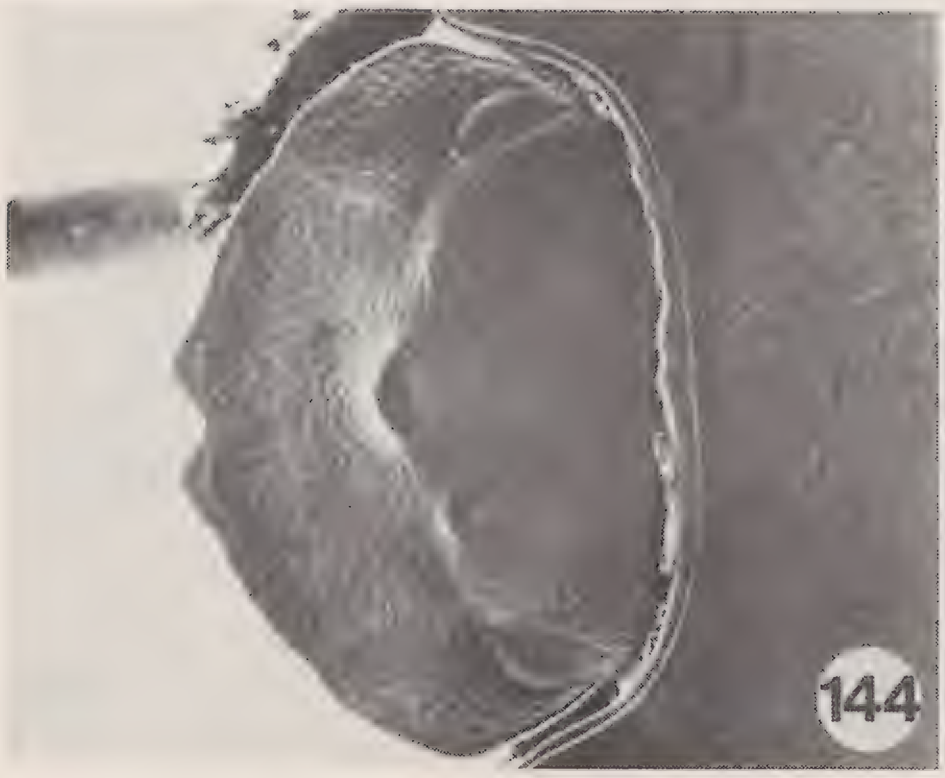

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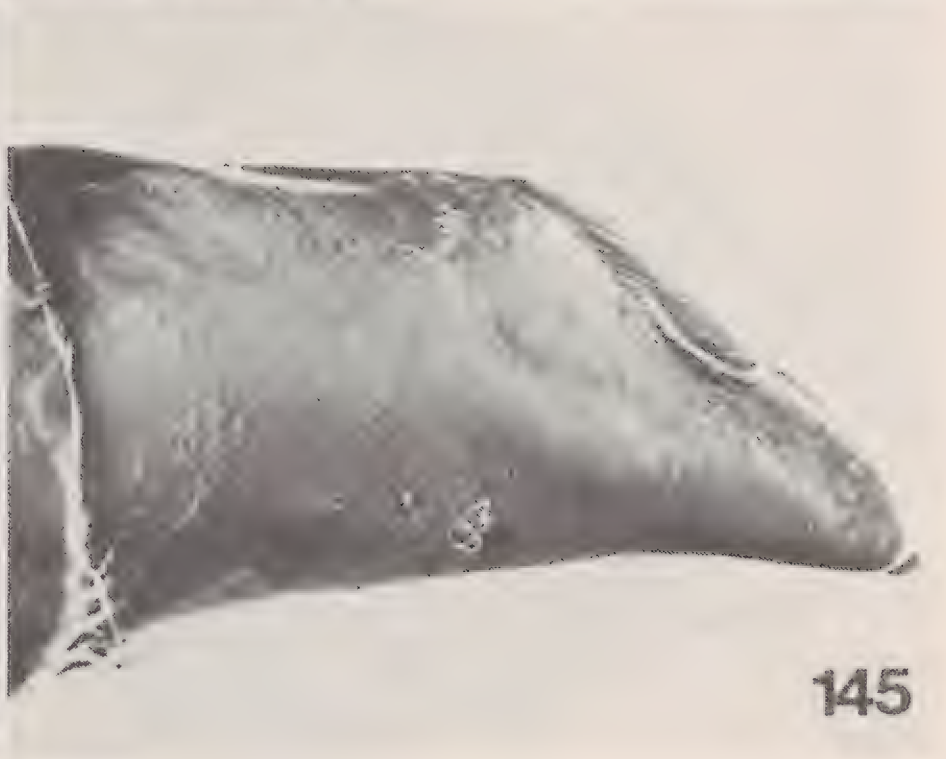

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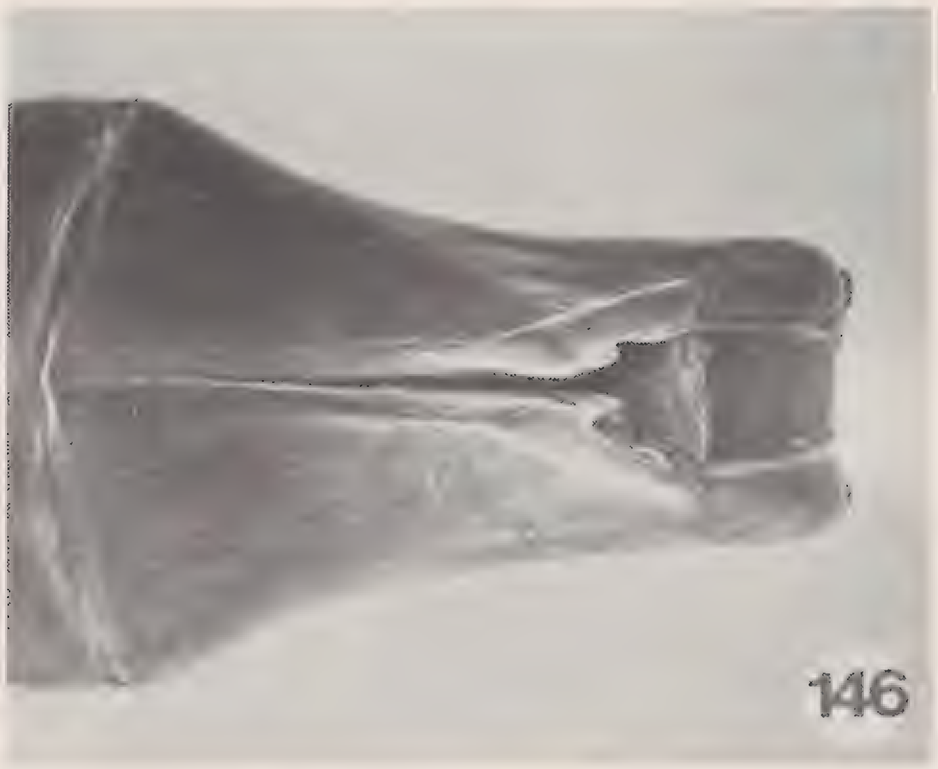
Fig. 140. *Canthidium elegantulum* Balth., male genitalia, dorsal view. Figs. 141–143. *Canthidium bituberifrons* n. sp. 141. Head. 142. Male genitalia, lateral view. 143. Male genitalia, dorsal view. Figs. 144, 145. *Canthidium discopygidiale* n. sp. 144. Head. 145. Male genitalia, lateral view.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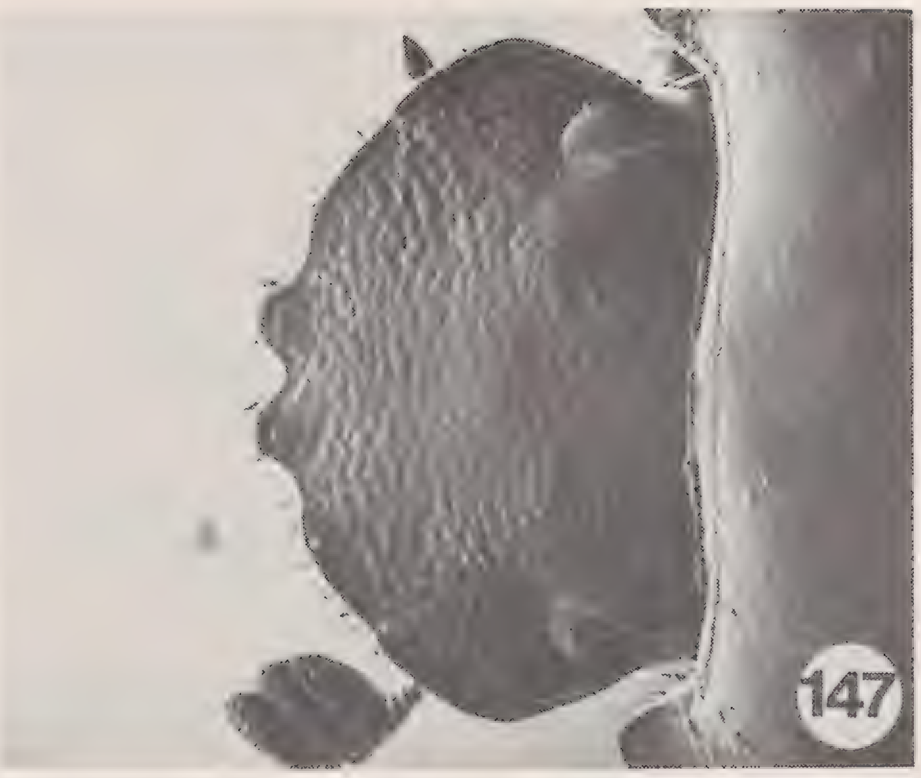
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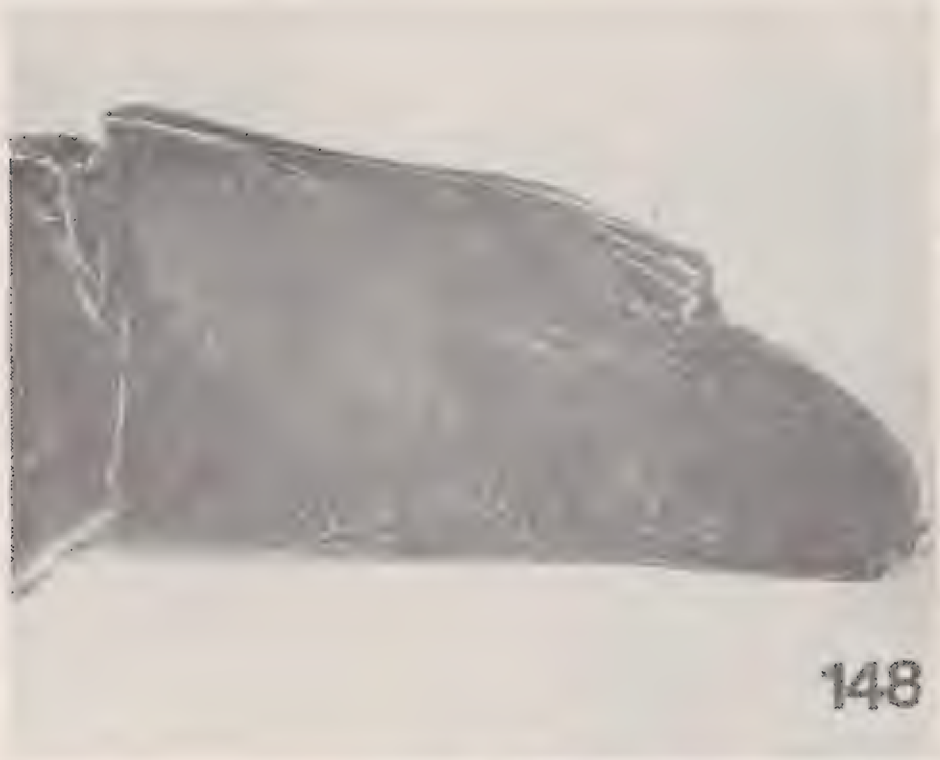
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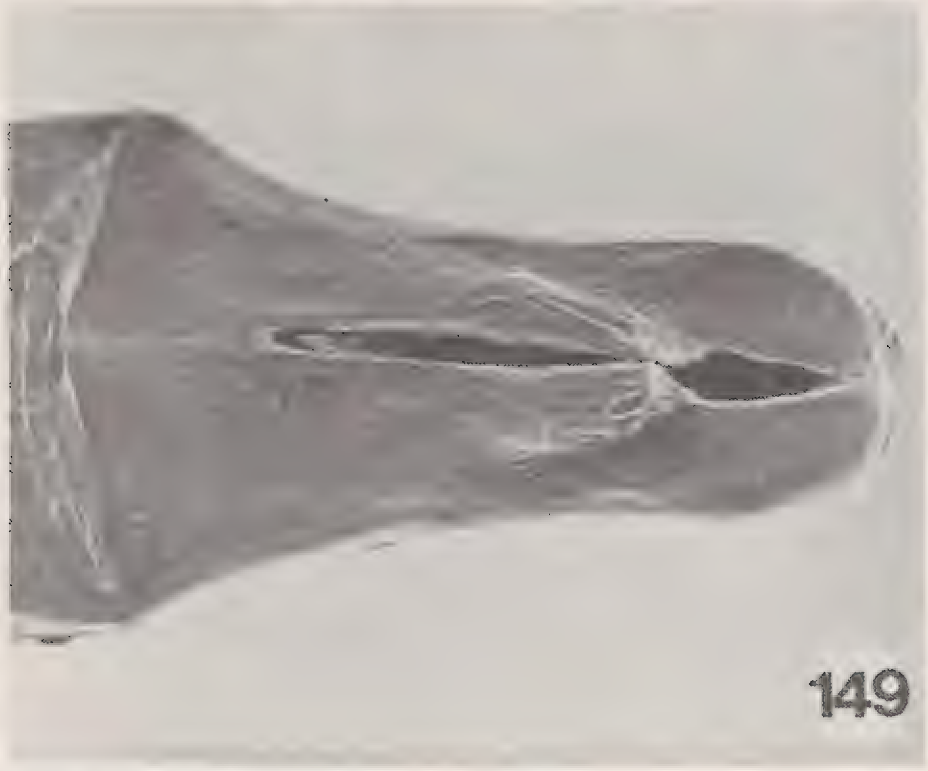
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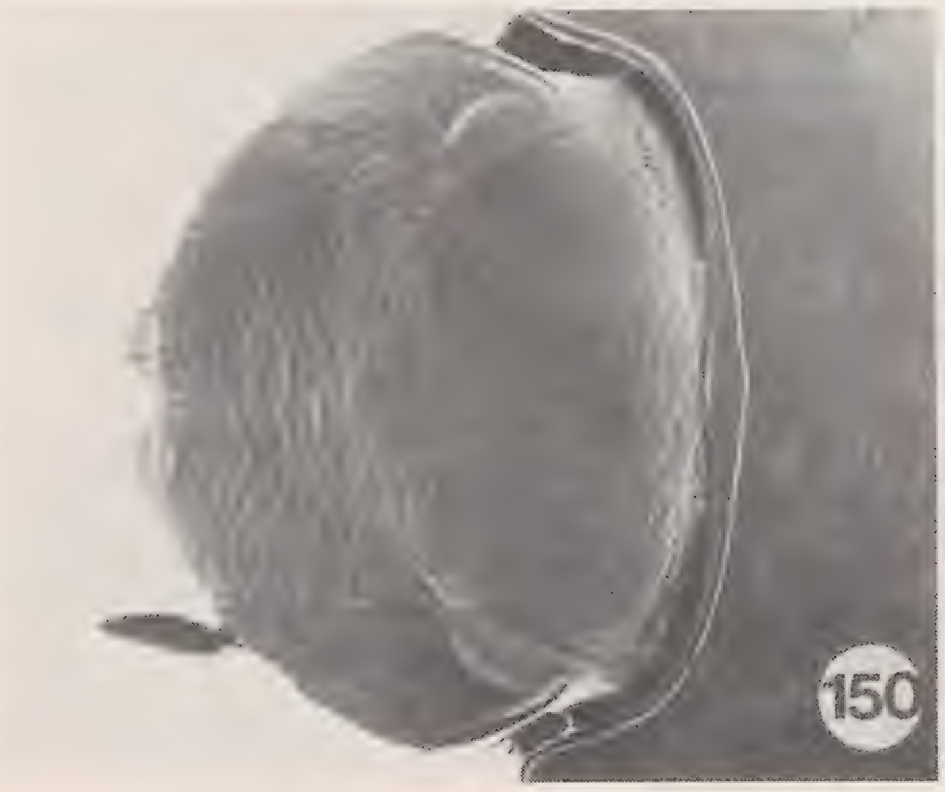
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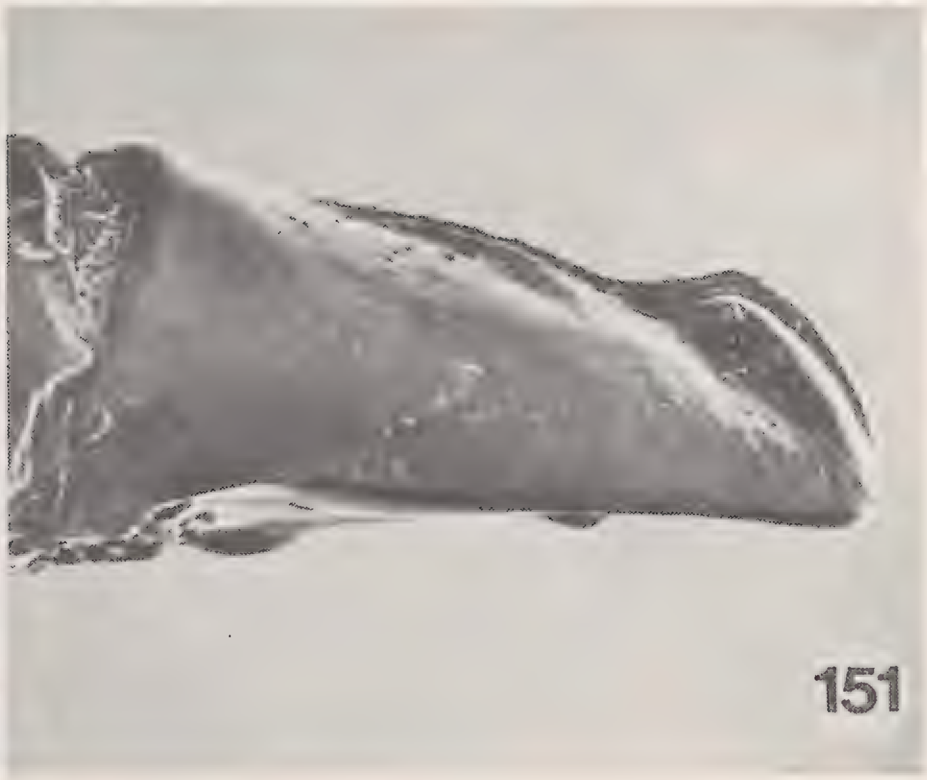
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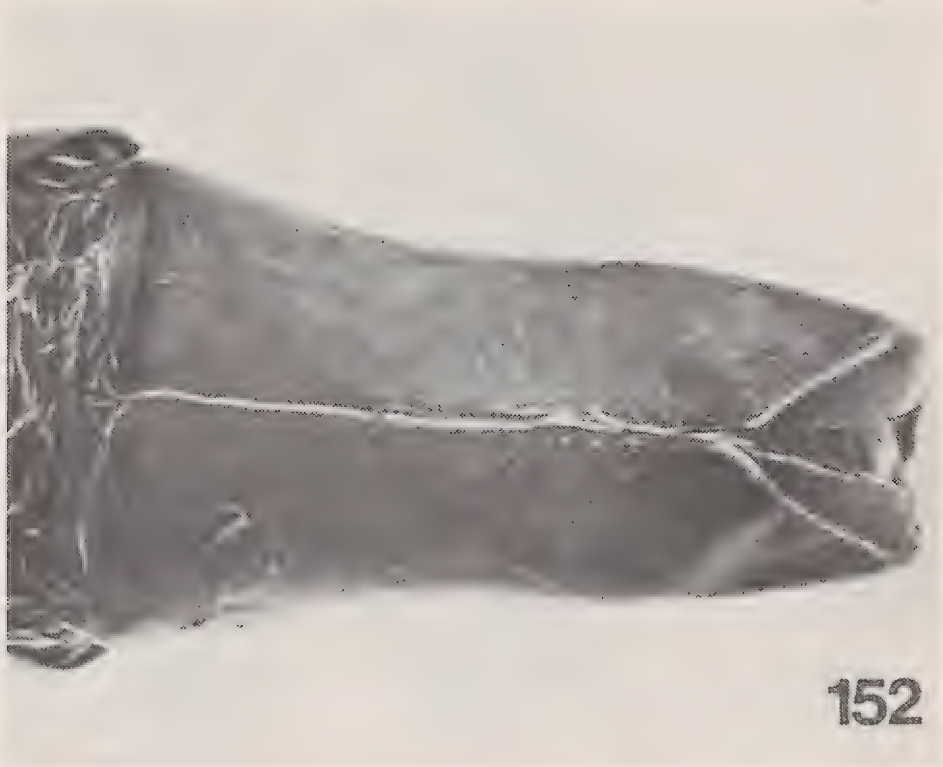
Fig. 146. Canthidium discopygidiale n. sp., male genitalia, dorsal view. Figs. 147–149. Canthidium subdopuncticolle n. sp. 147. Head. 148. Male genitalia, lateral view. 149. Male genitalia, dorsal view. Figs. 150, 151. Canthidium tenebrosum n. sp. 150. Head. 151. Male genitalia, lateral view.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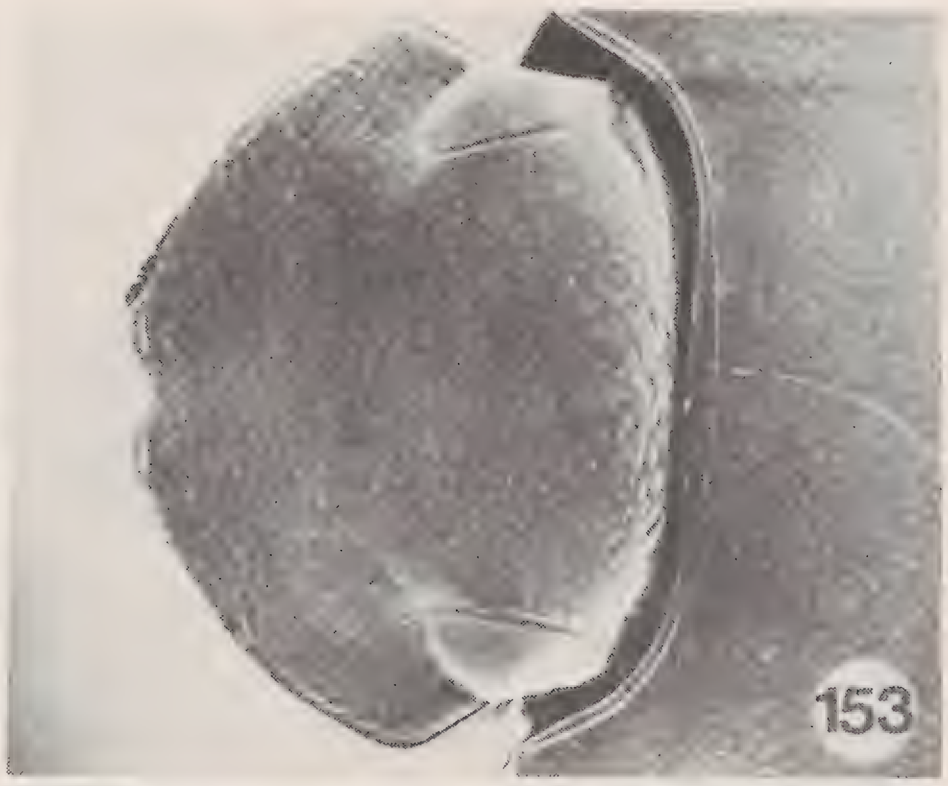
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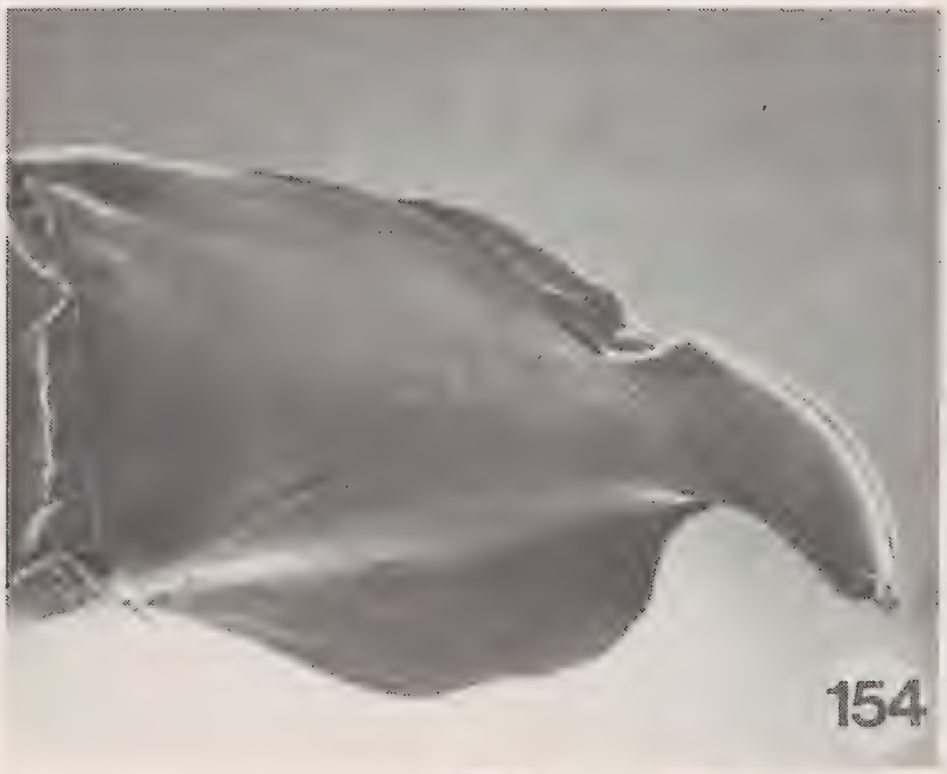
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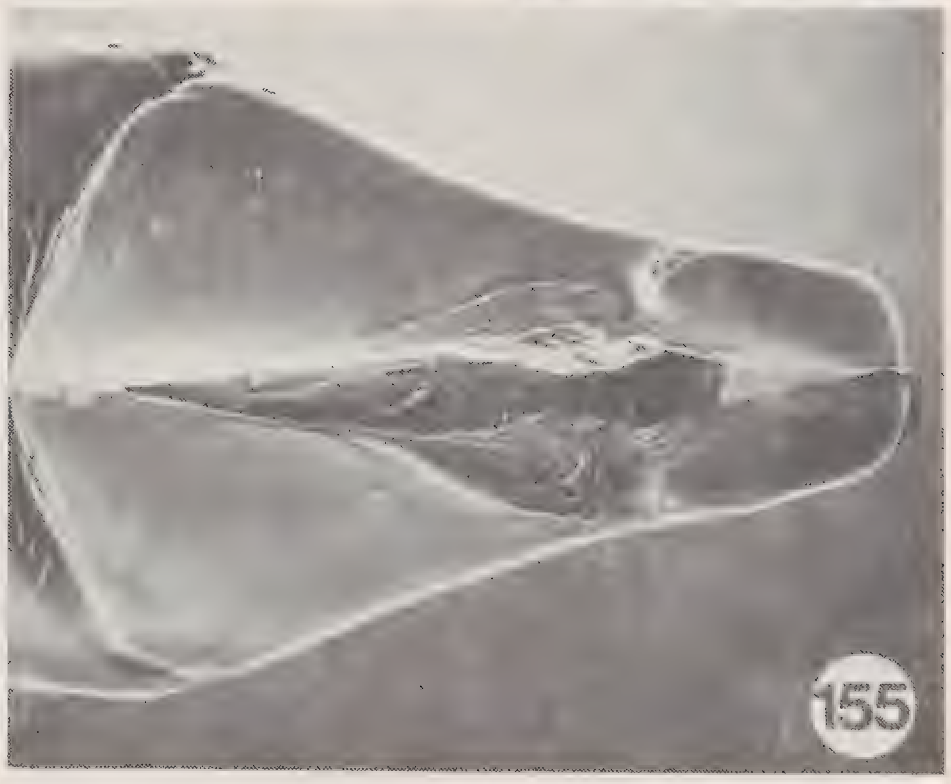
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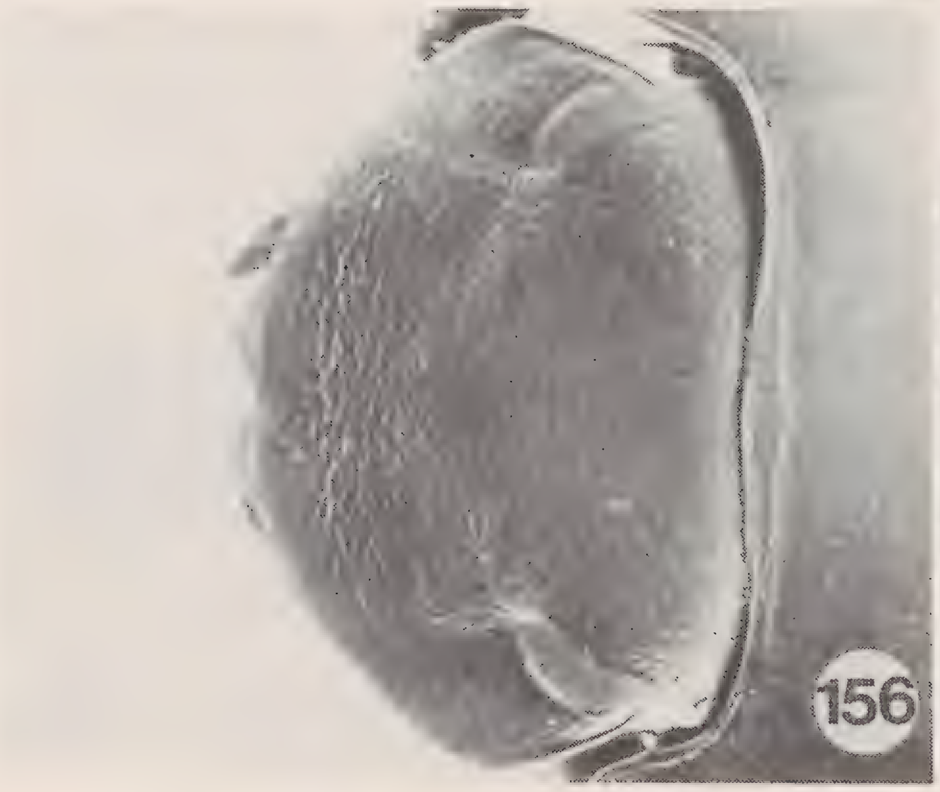
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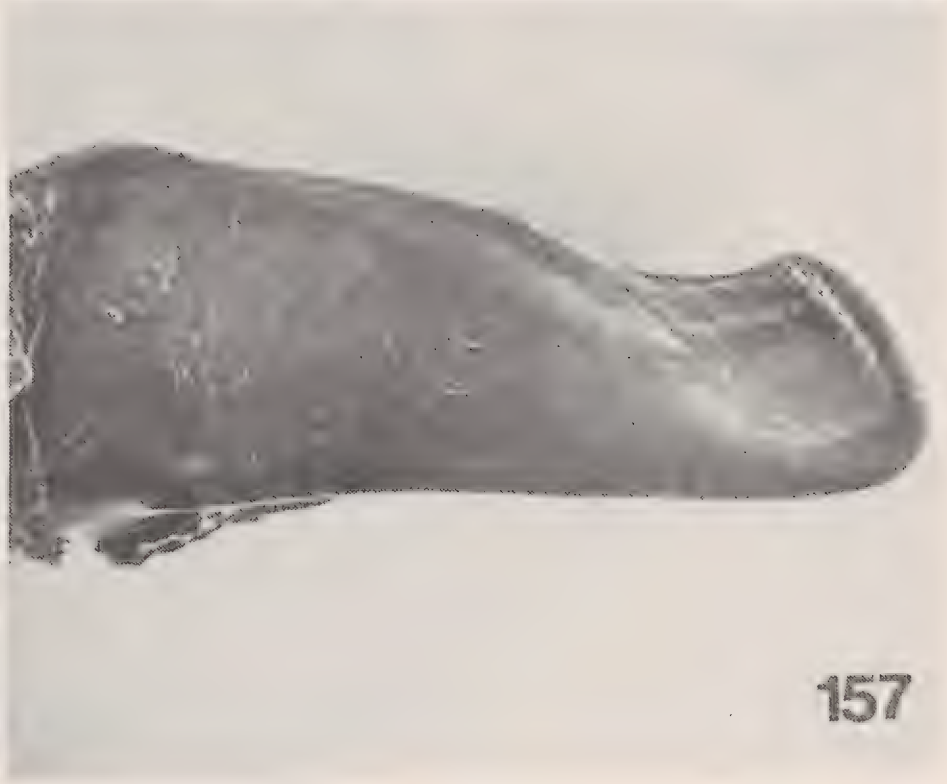
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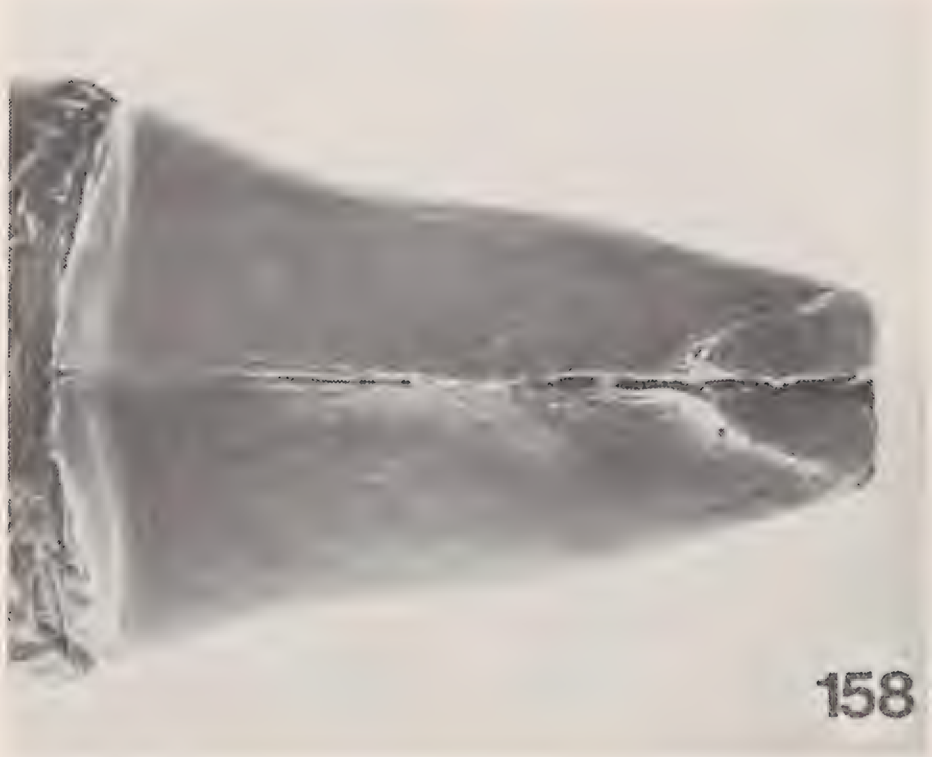
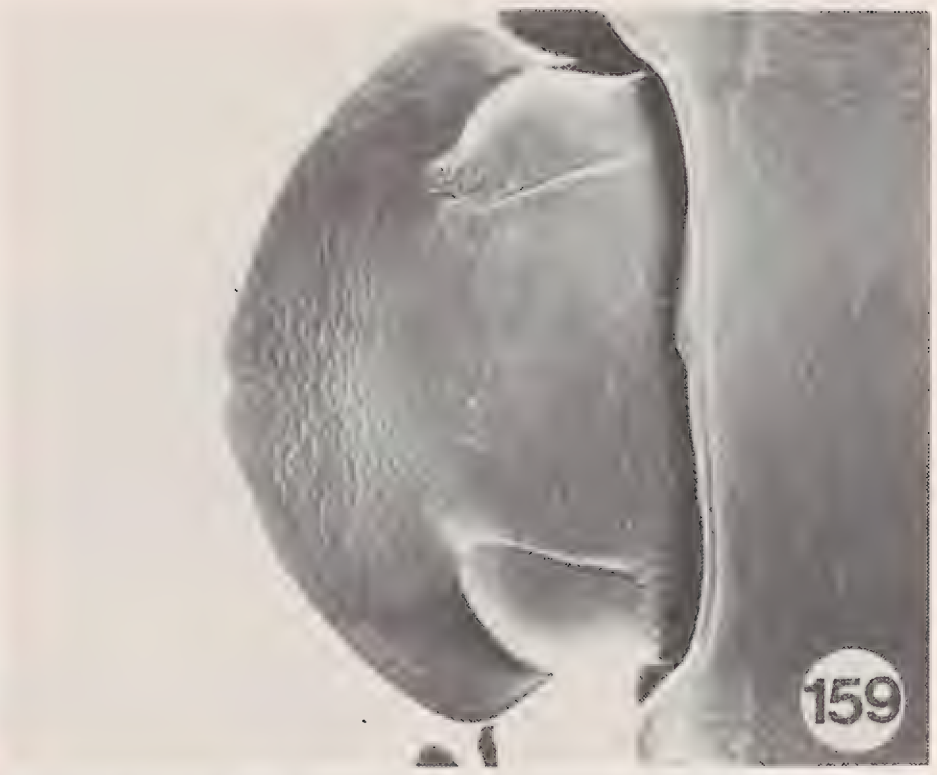
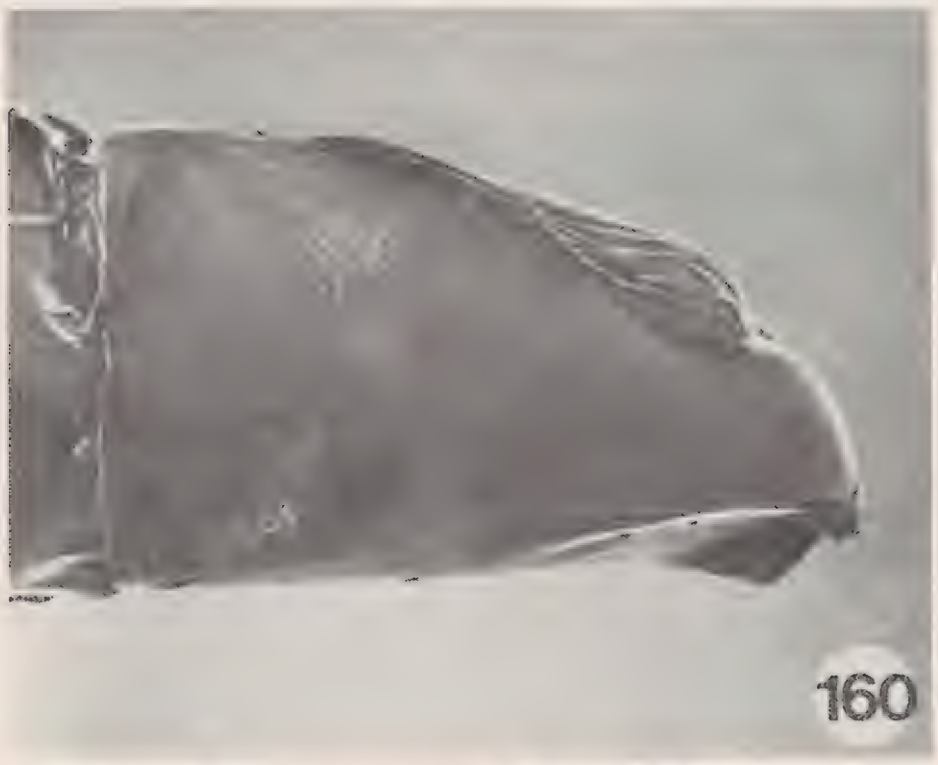
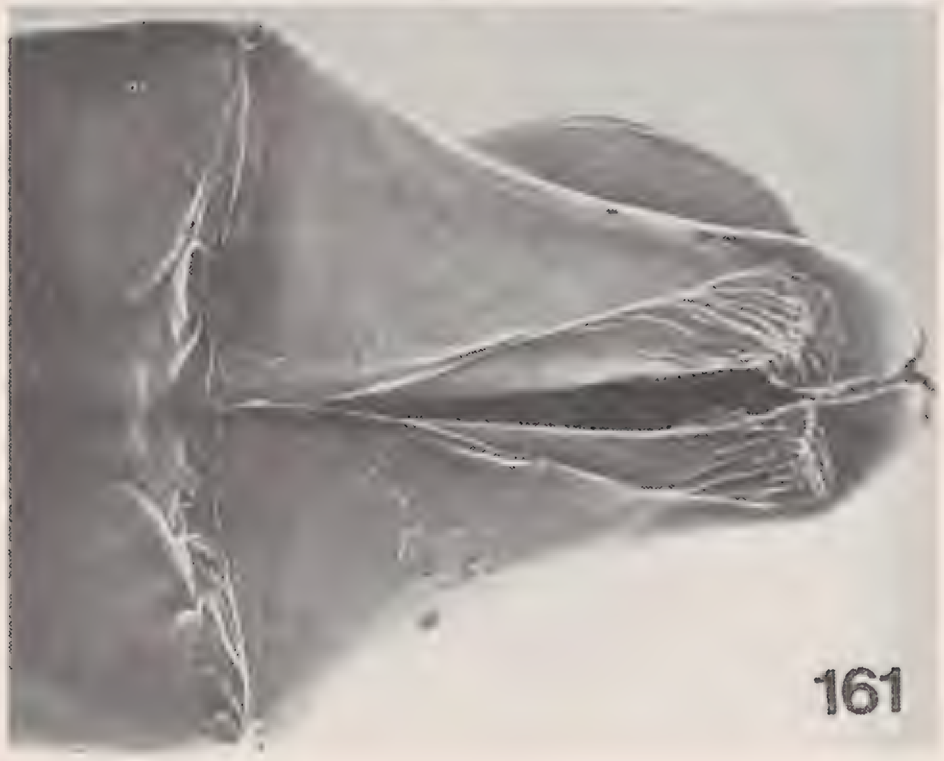
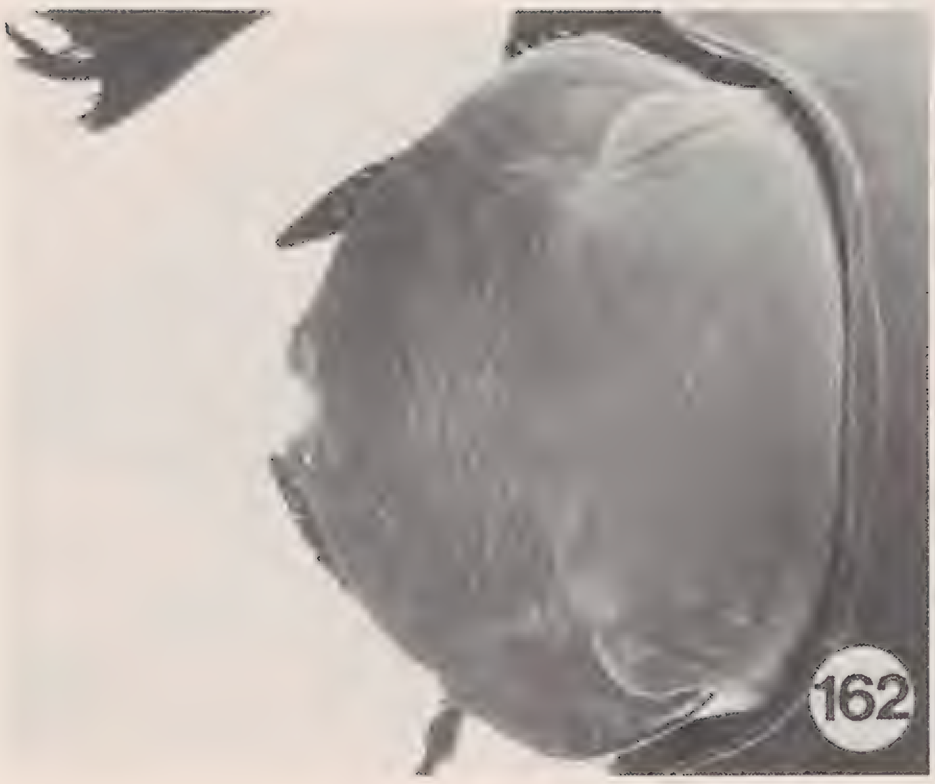
Fig. 152. Canthidium tenebrosum n. sp., male genitalia, dorsal view. Figs. 153–155. Canthidium planovultum n. sp. 153. Head. 154. Male genitalia, lateral view. 155. Male genitalia, dorsal view. Figs. 156, 157. Canthidium perceptibile n. sp. 156. Head. 157. Male genitalia, lateral view.











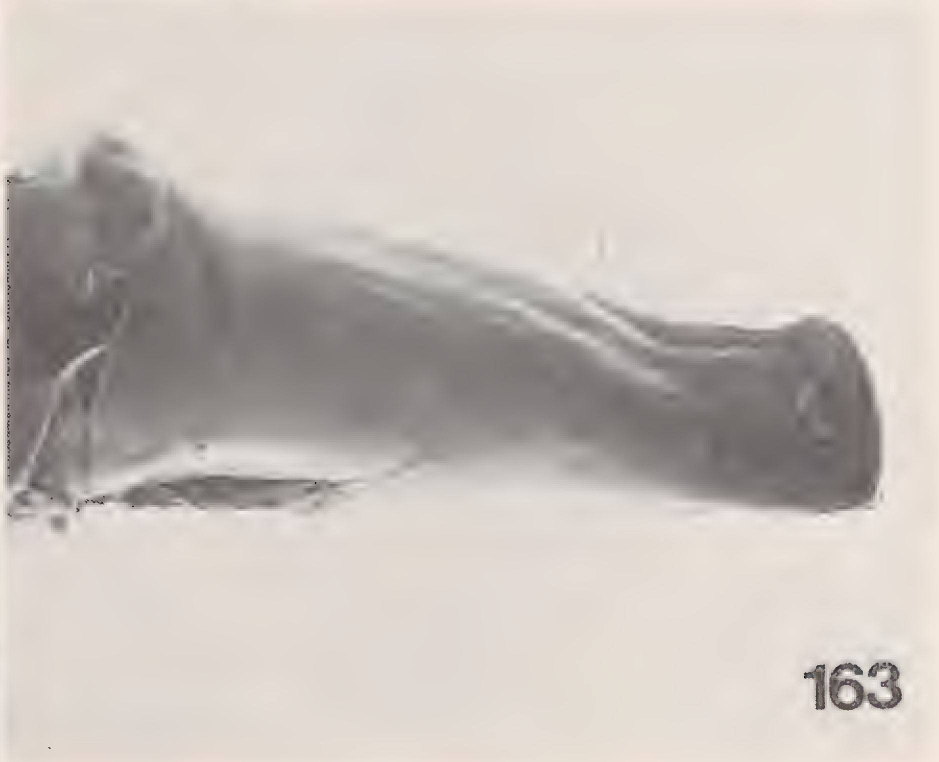
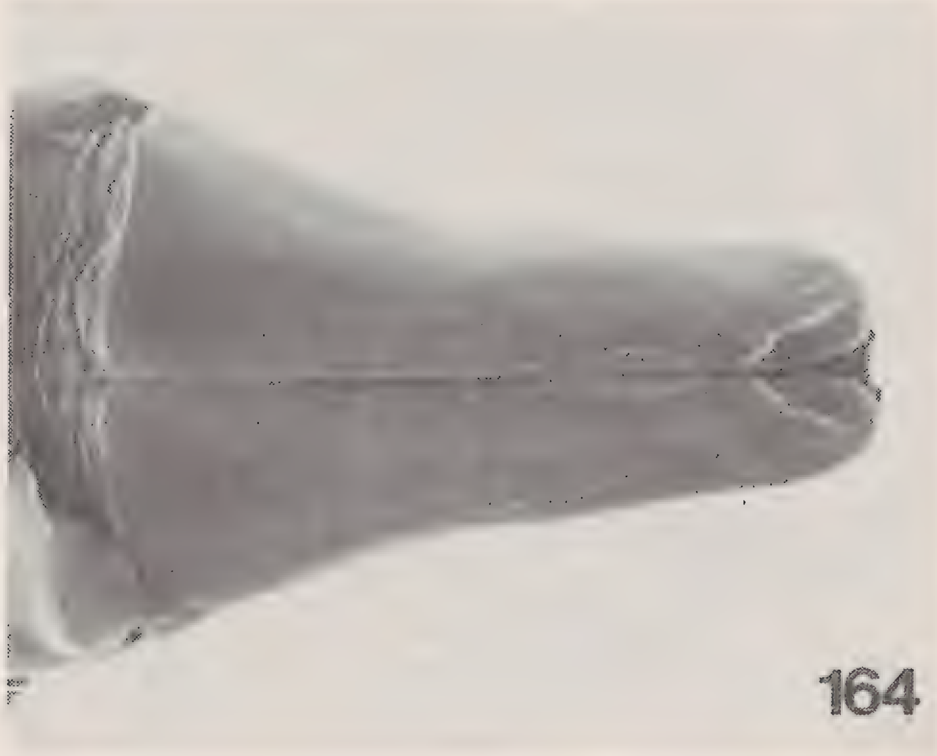


Fig. 158. *Canthidium perceptibile* n. sp., male genitalia, dorsal view. Figs. 159-161. *Canthidium vespertinum* n. sp. 159. Head. 160. Male genitalia, lateral view. 161. Male genitalia, dorsal view. Figs. 162, 163. *Canthidium pallidoalatum* n. sp. 162. Head. 163. Male genitalia, lateral view.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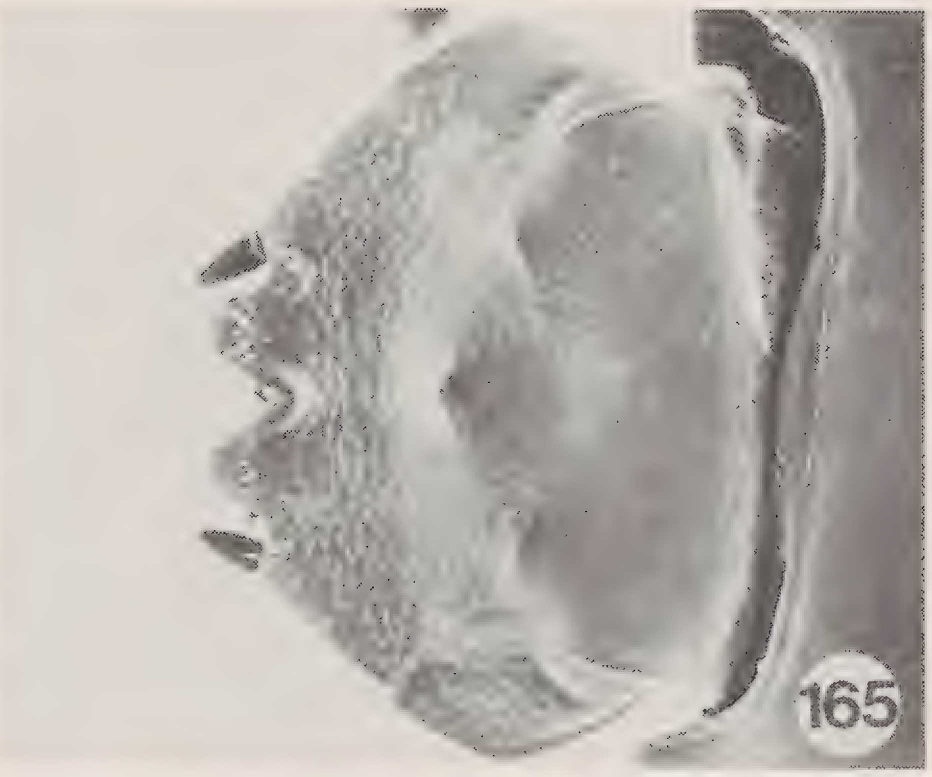
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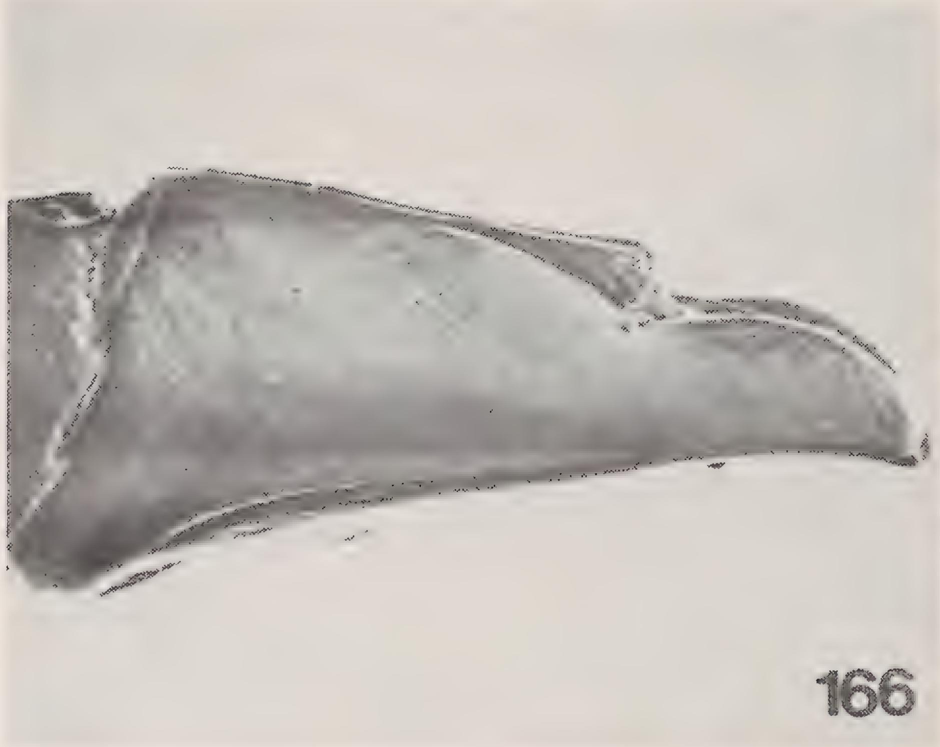
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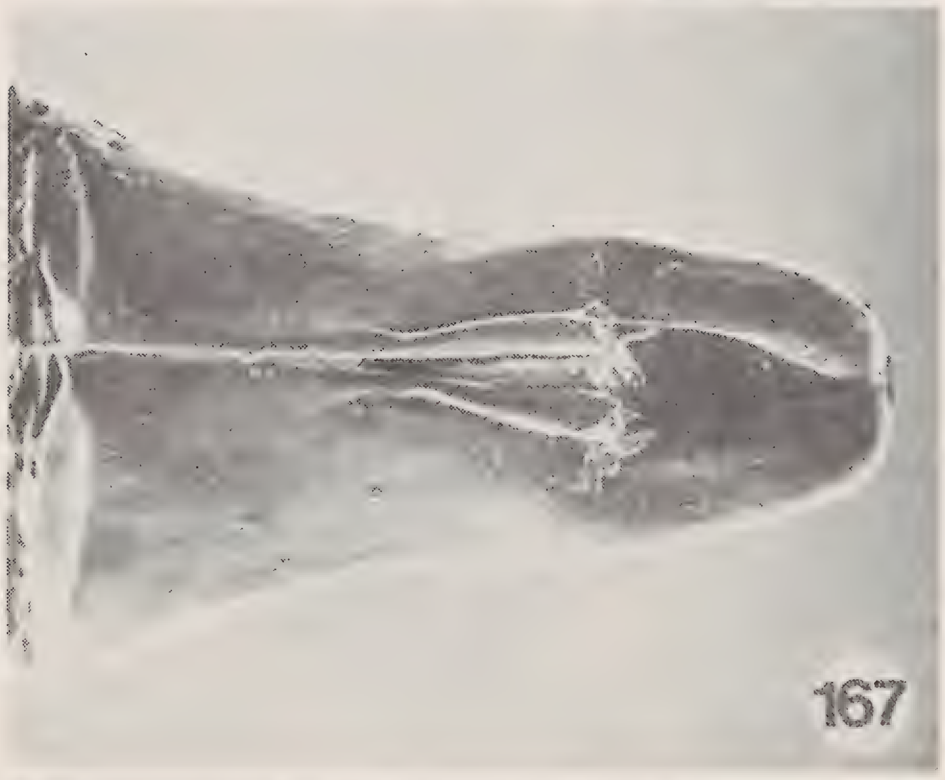
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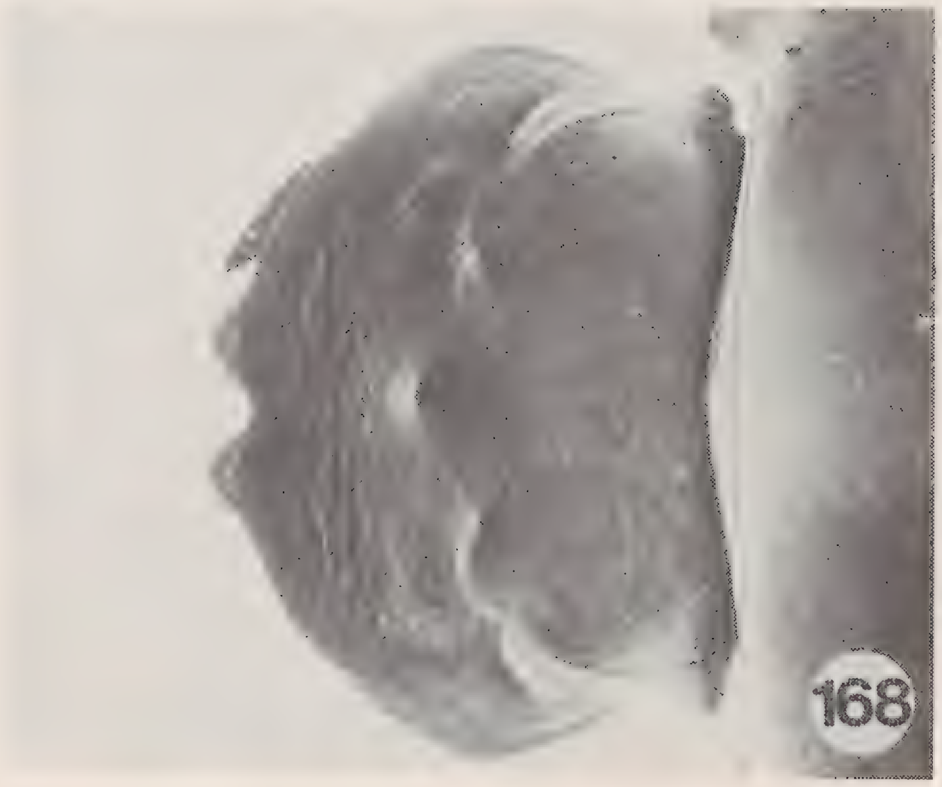
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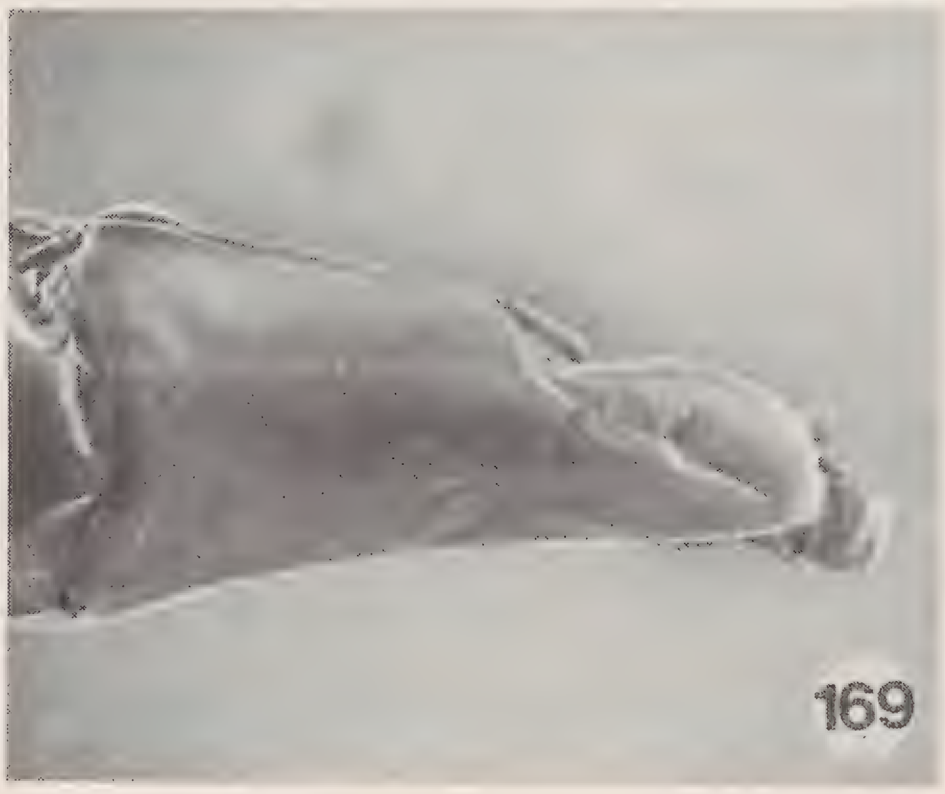
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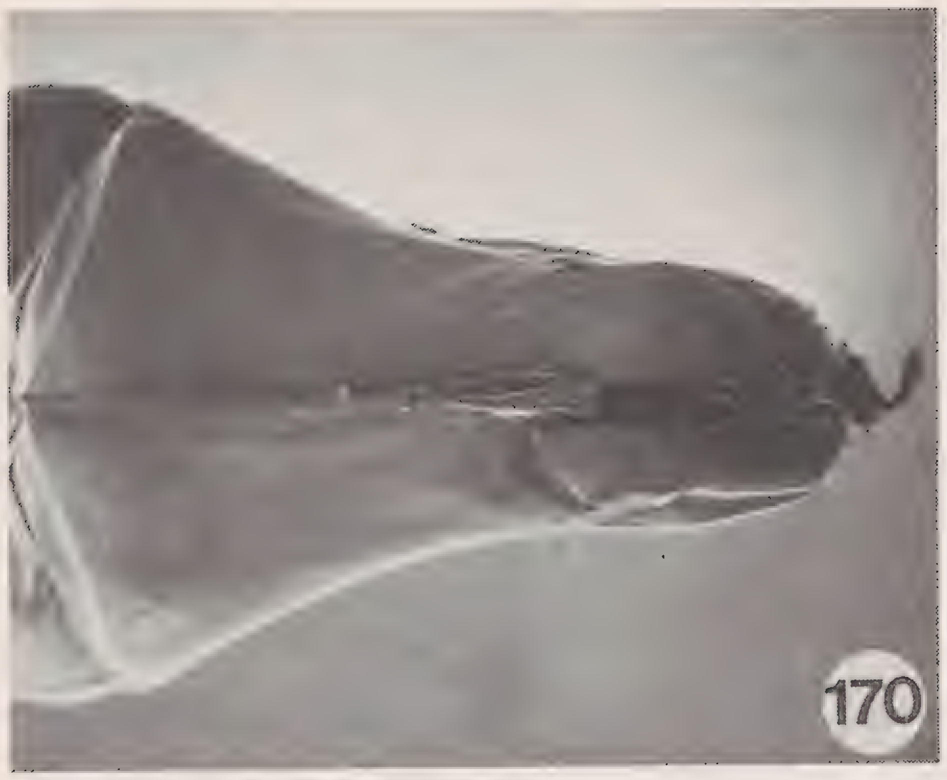
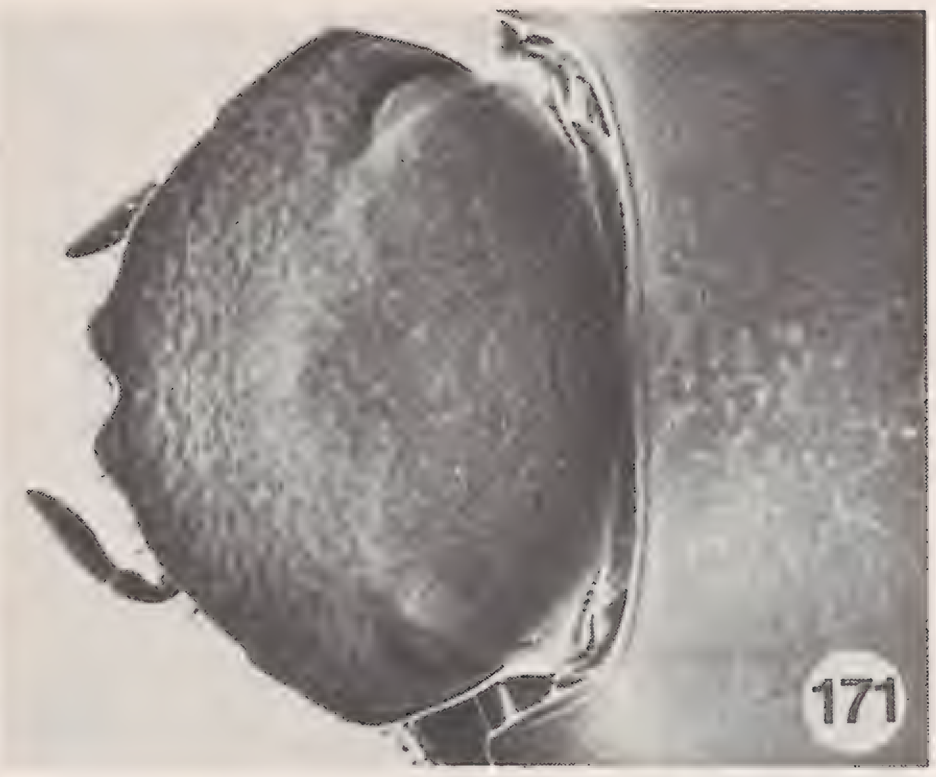
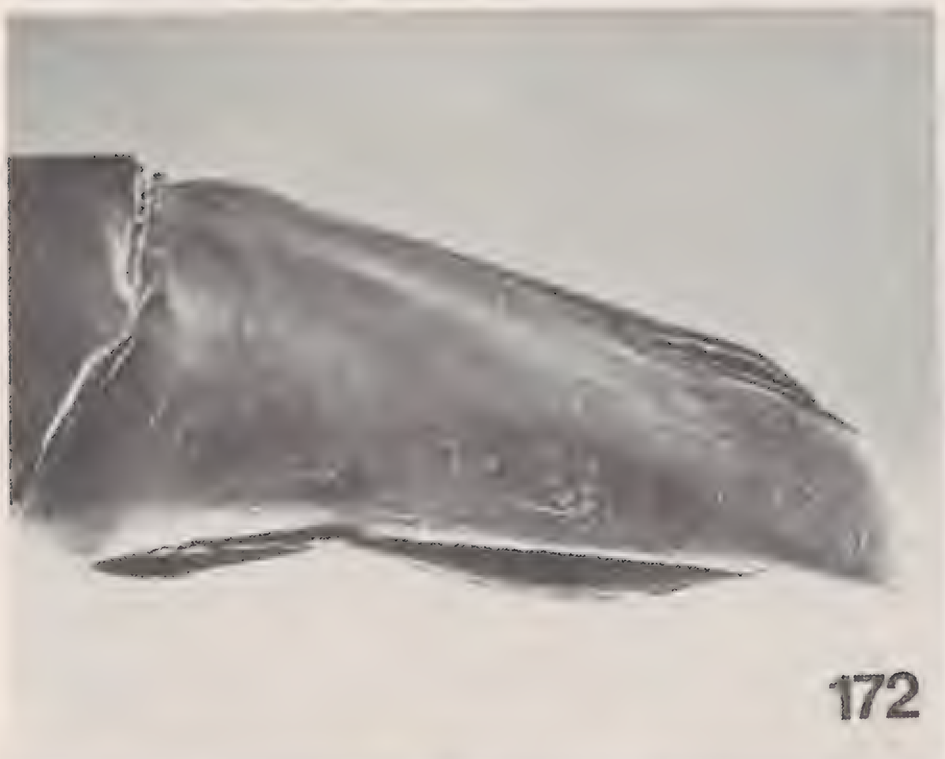
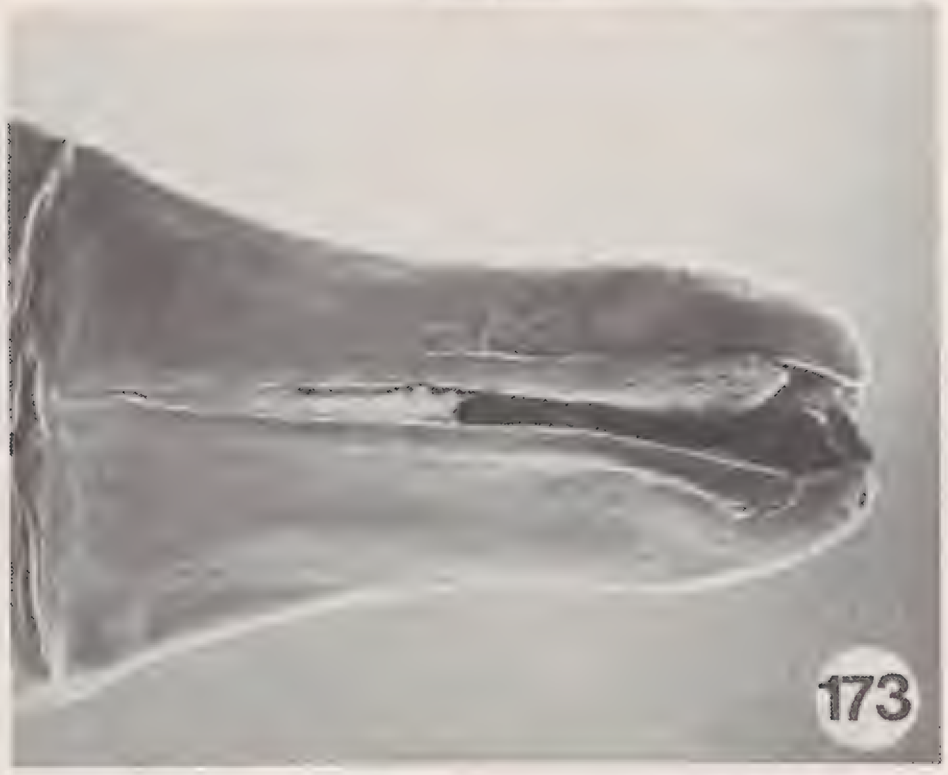
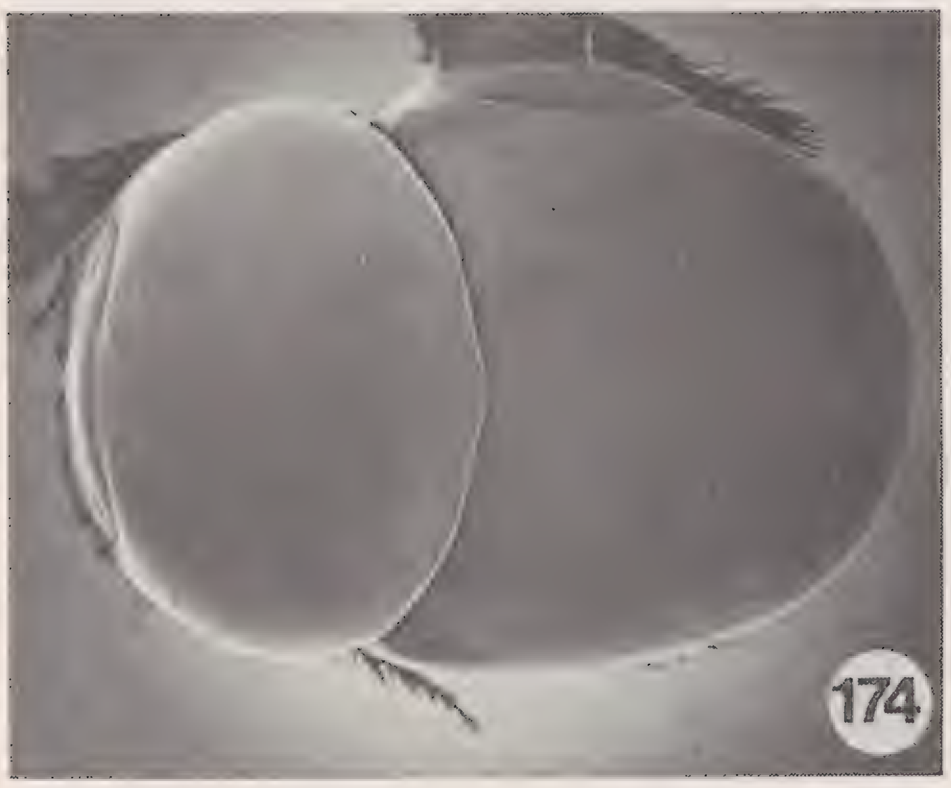
Fig. 164. Canthidium pallidoalatum n. sp., male genitalia, dorsal view. Figs. 165-167. Canthidium variolosum n. sp. 165. Head. 166. Male genitalia, lateral view. 167. Male genitalia, dorsal view. Figs. 168, 169. Canthidium leucopterum n. sp. 168. Head. 169. Male genitalia, lateral view.











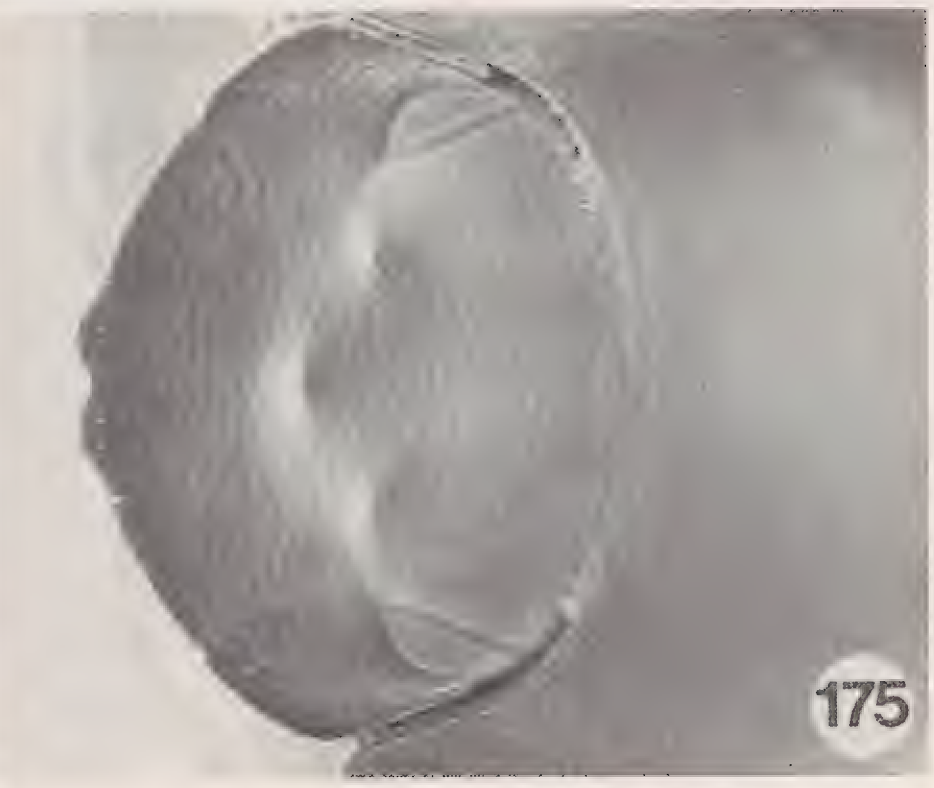
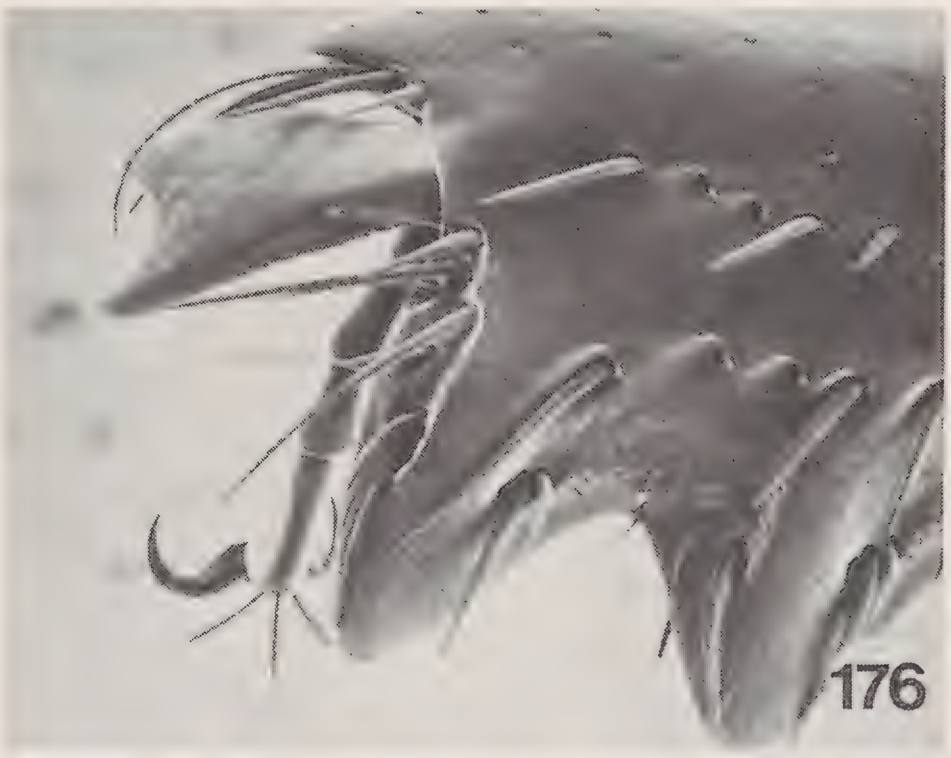


Fig. 170. Canthidium leucopterum n. sp., male genitalia, dorsal view. Figs. 171–173. Canthidium ardens Bates. 171. Head. 172. Male genitalia, lateral view. 173. Male genitalia, dorsal view. Figs. 174, 175. Canthidium aurifex Bates. 174. Dorsum. 175. Head.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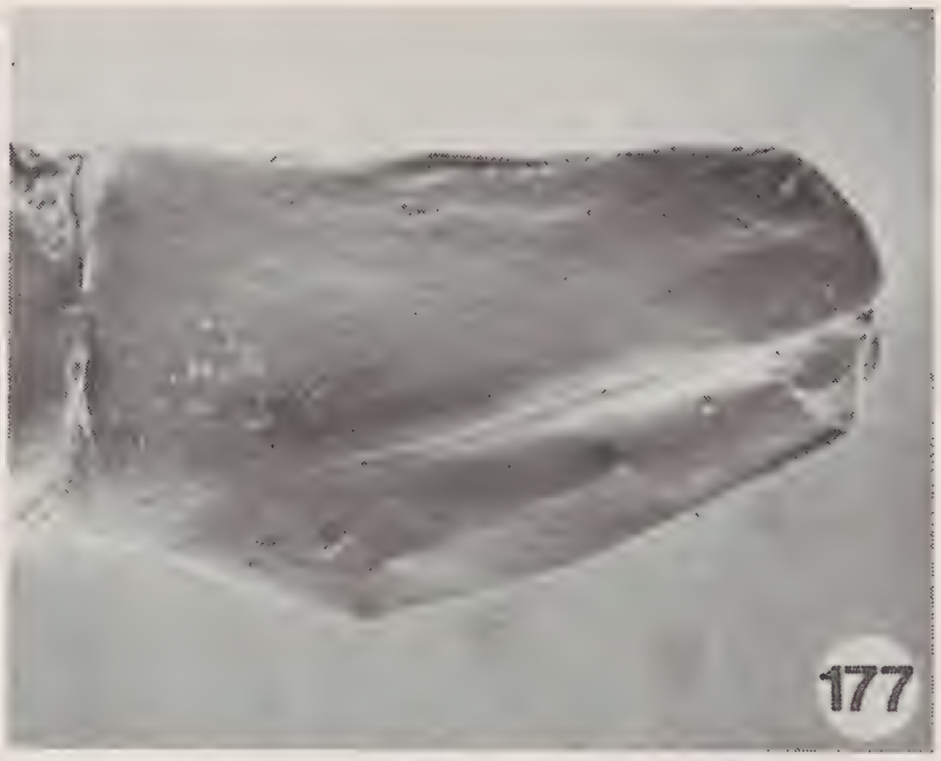
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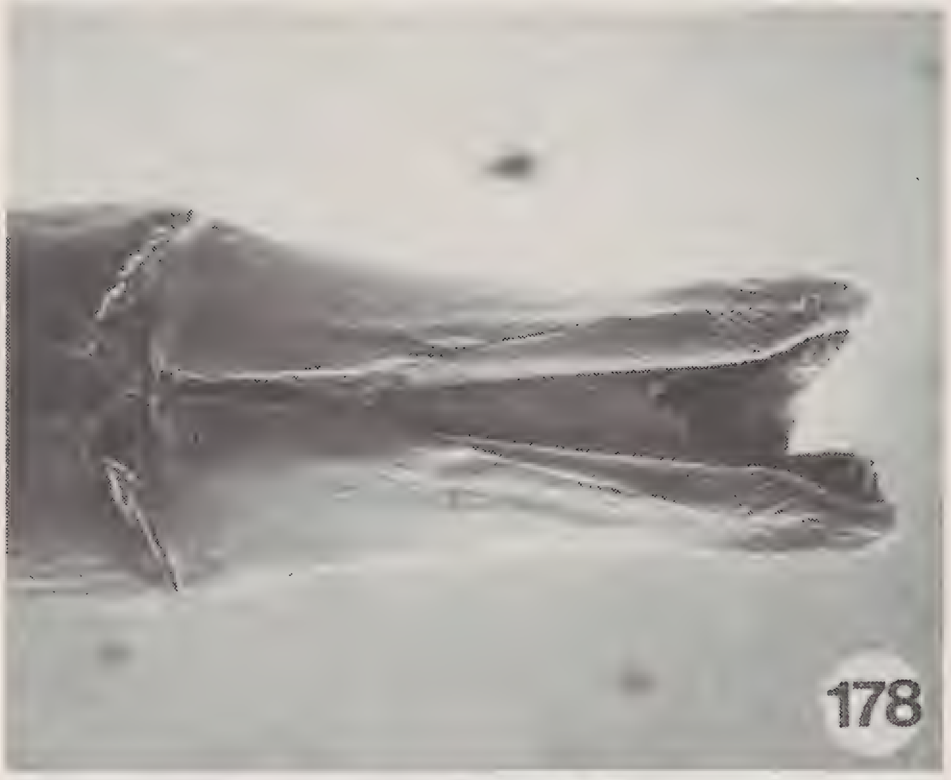
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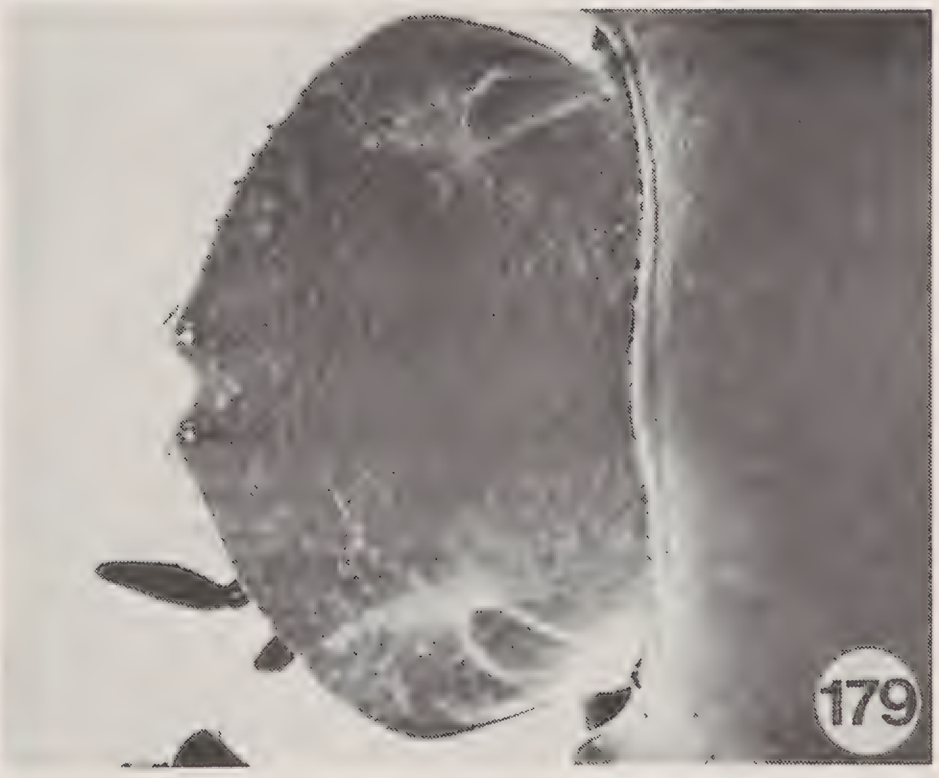
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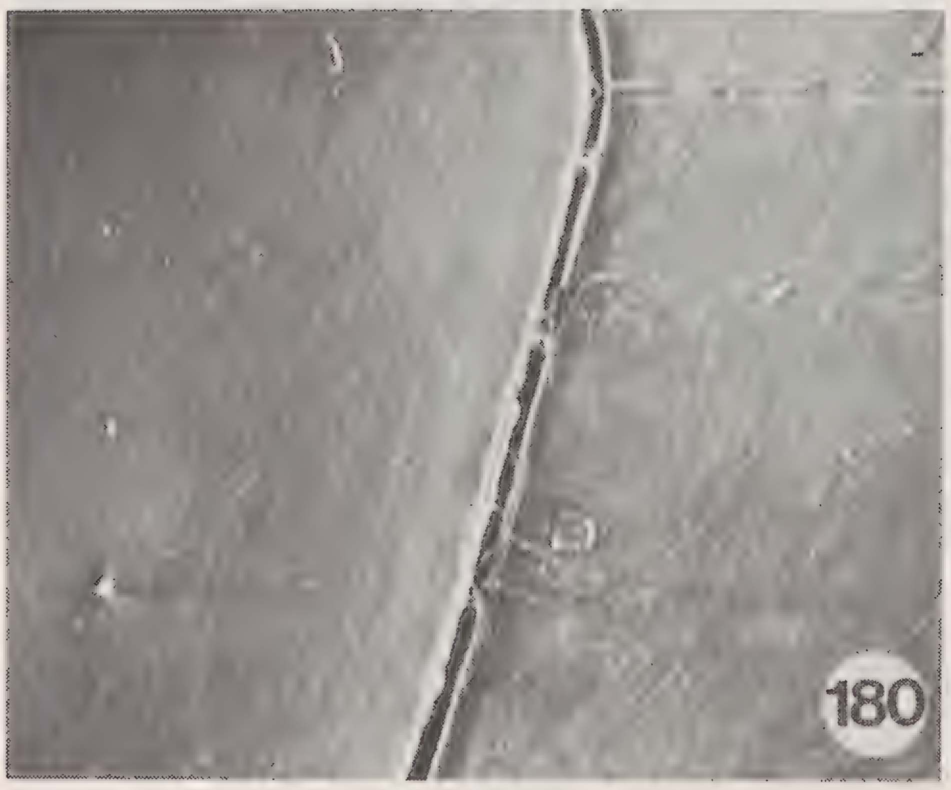
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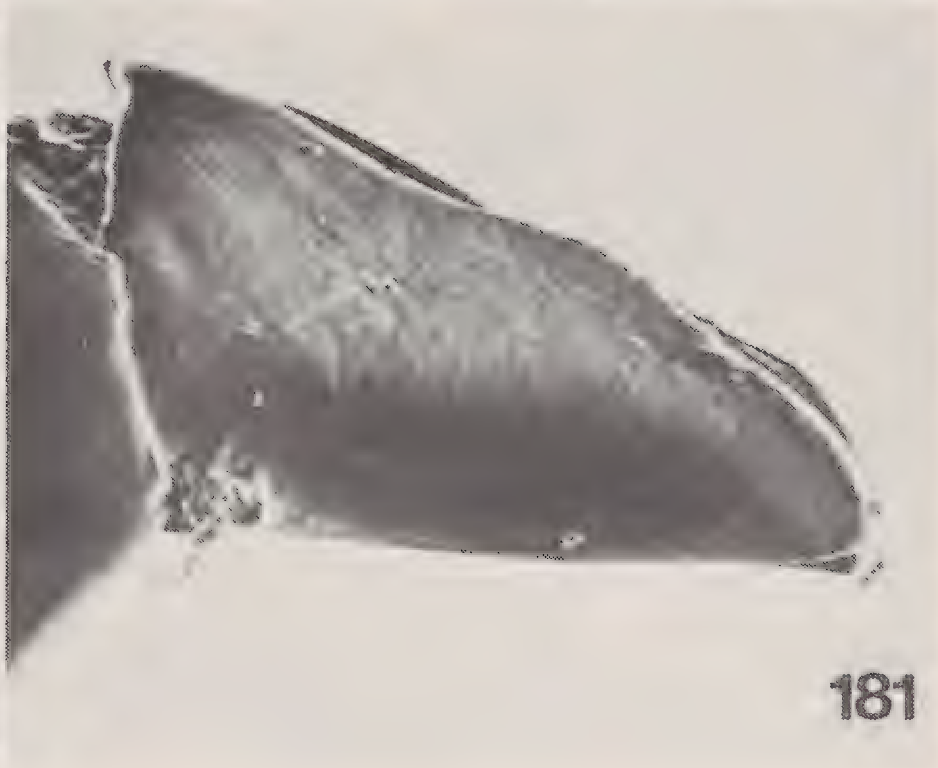
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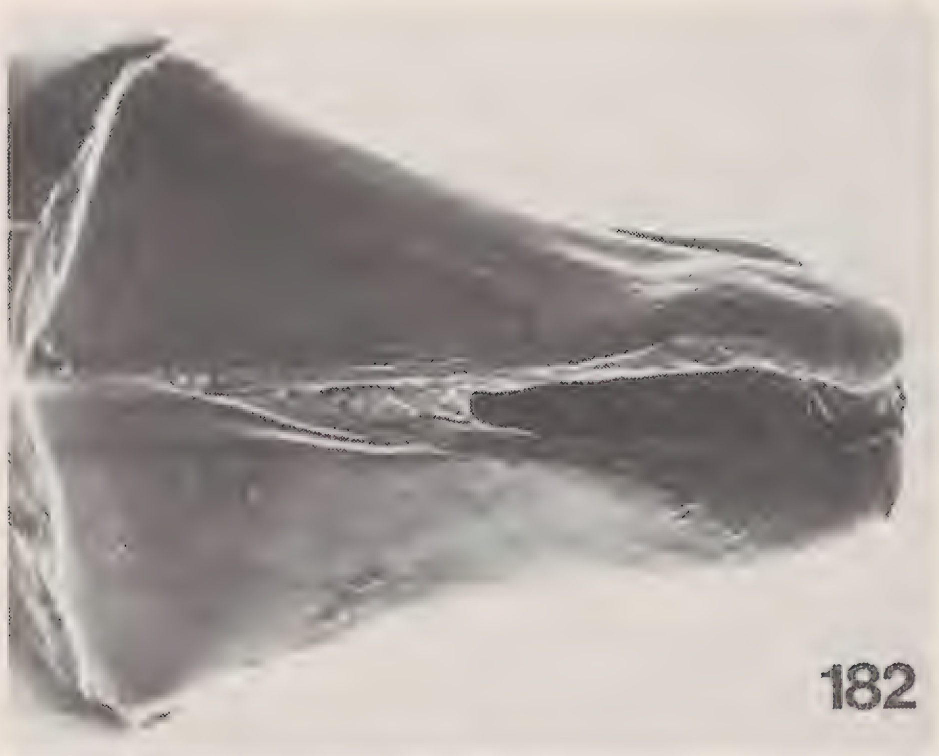
Figs. 176–178. Canthidium aurifex Bates. 176. Apex male fore tibia. 177. Male genitalia, lateral view. 178. Male genitalia, dorsal view. Figs. 179–181. Canthidium hespenheidei n. sp. 179. Head. 180. Posterior margin of pronotum. 181. Male genitalia, lateral view.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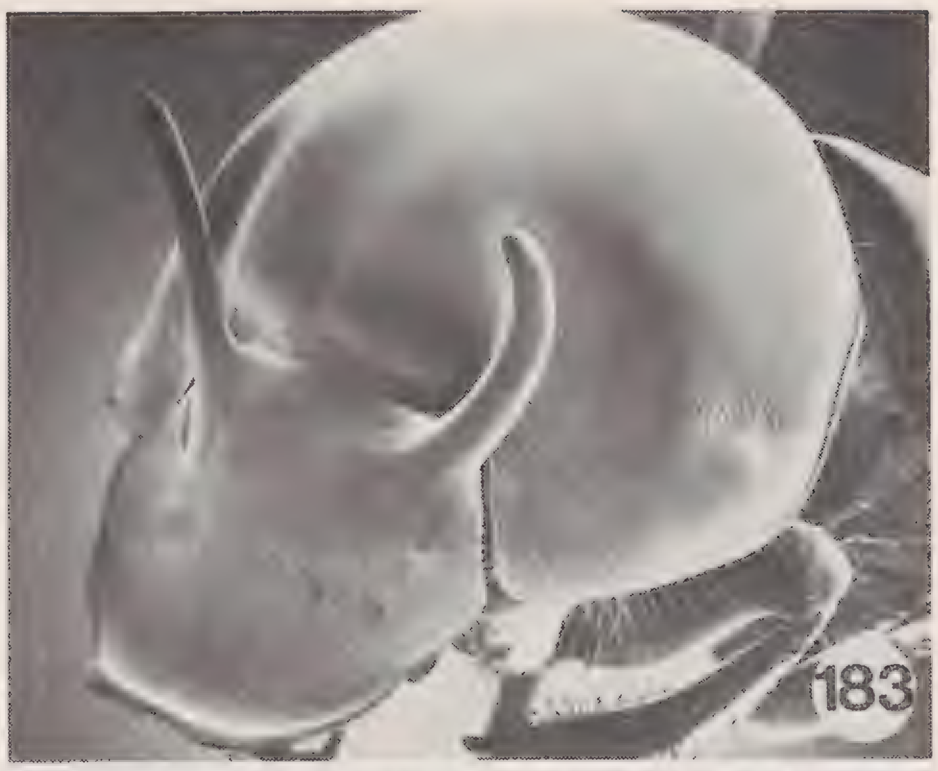
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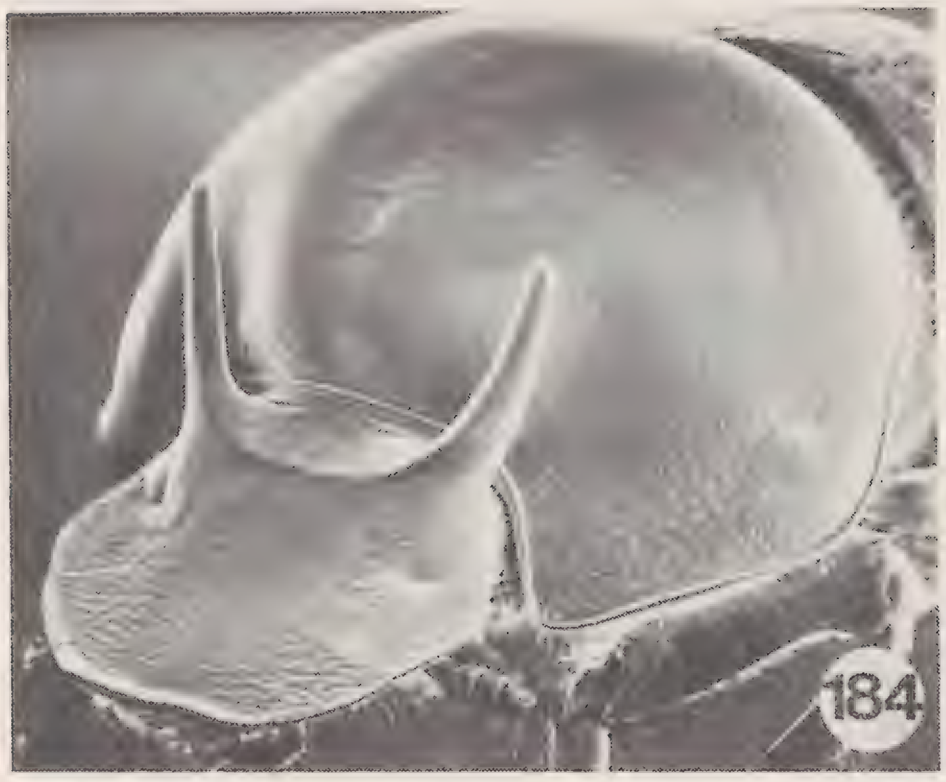
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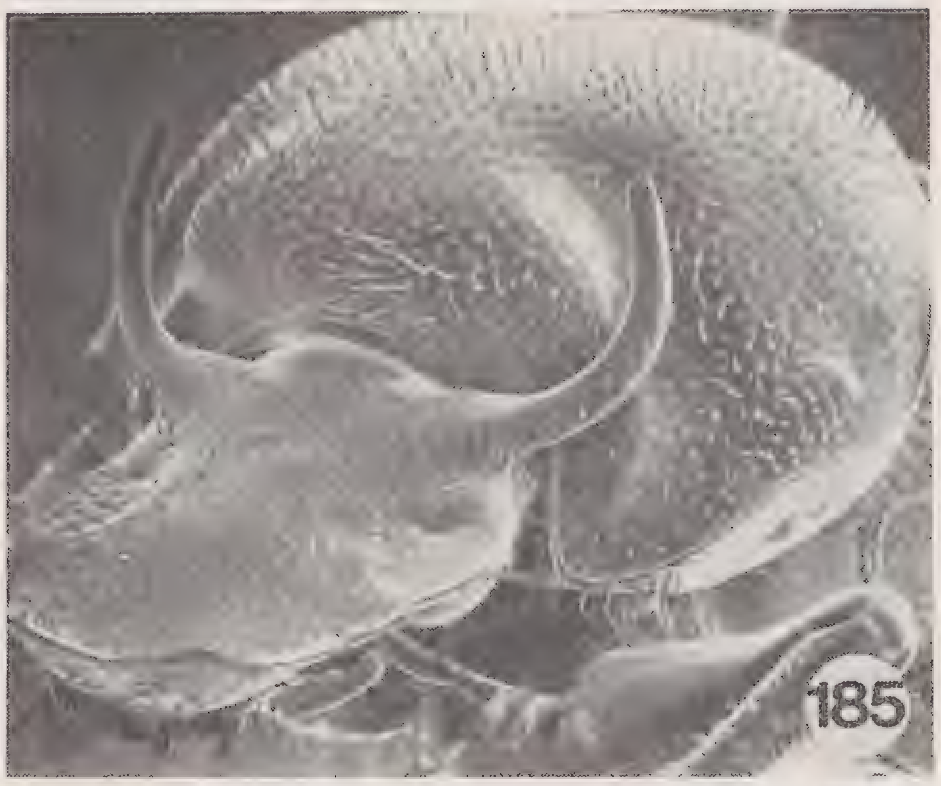
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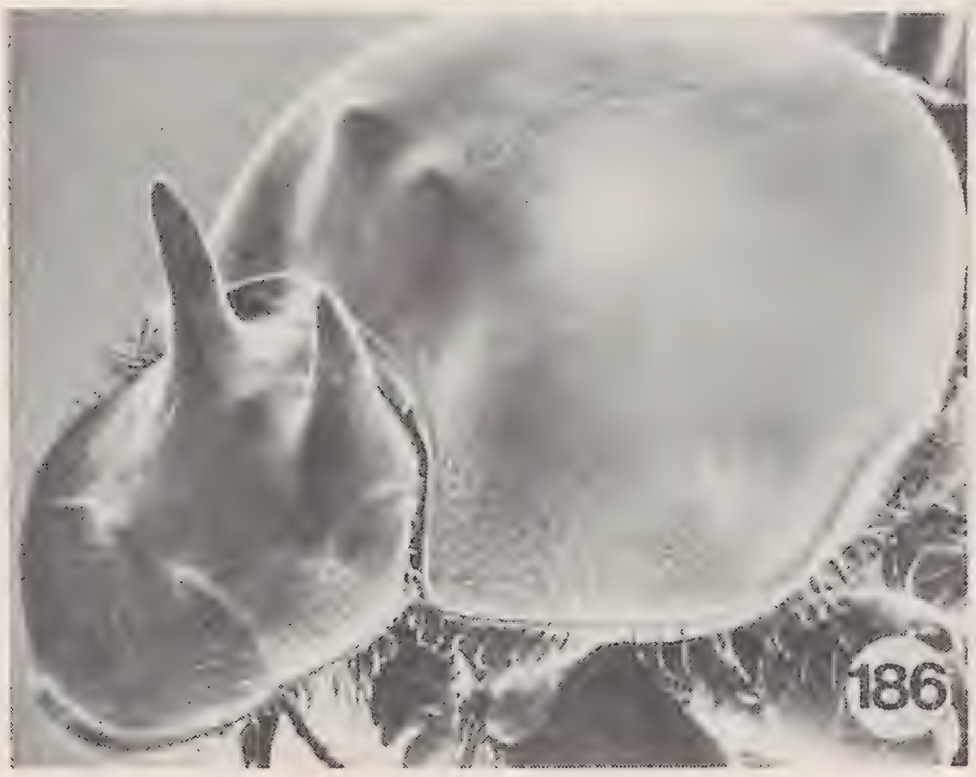
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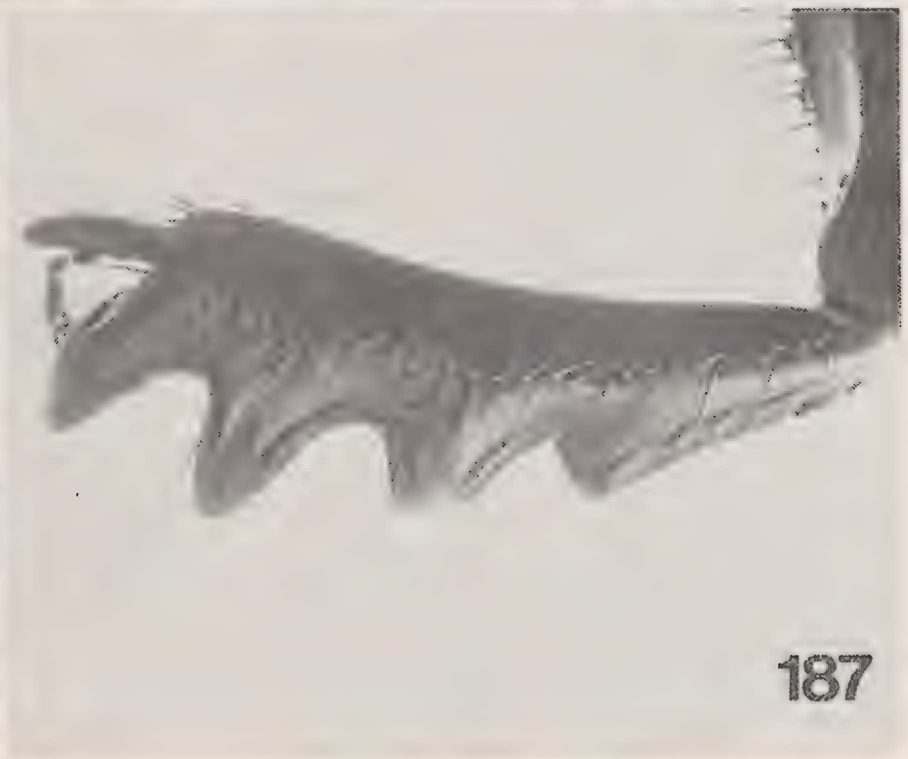
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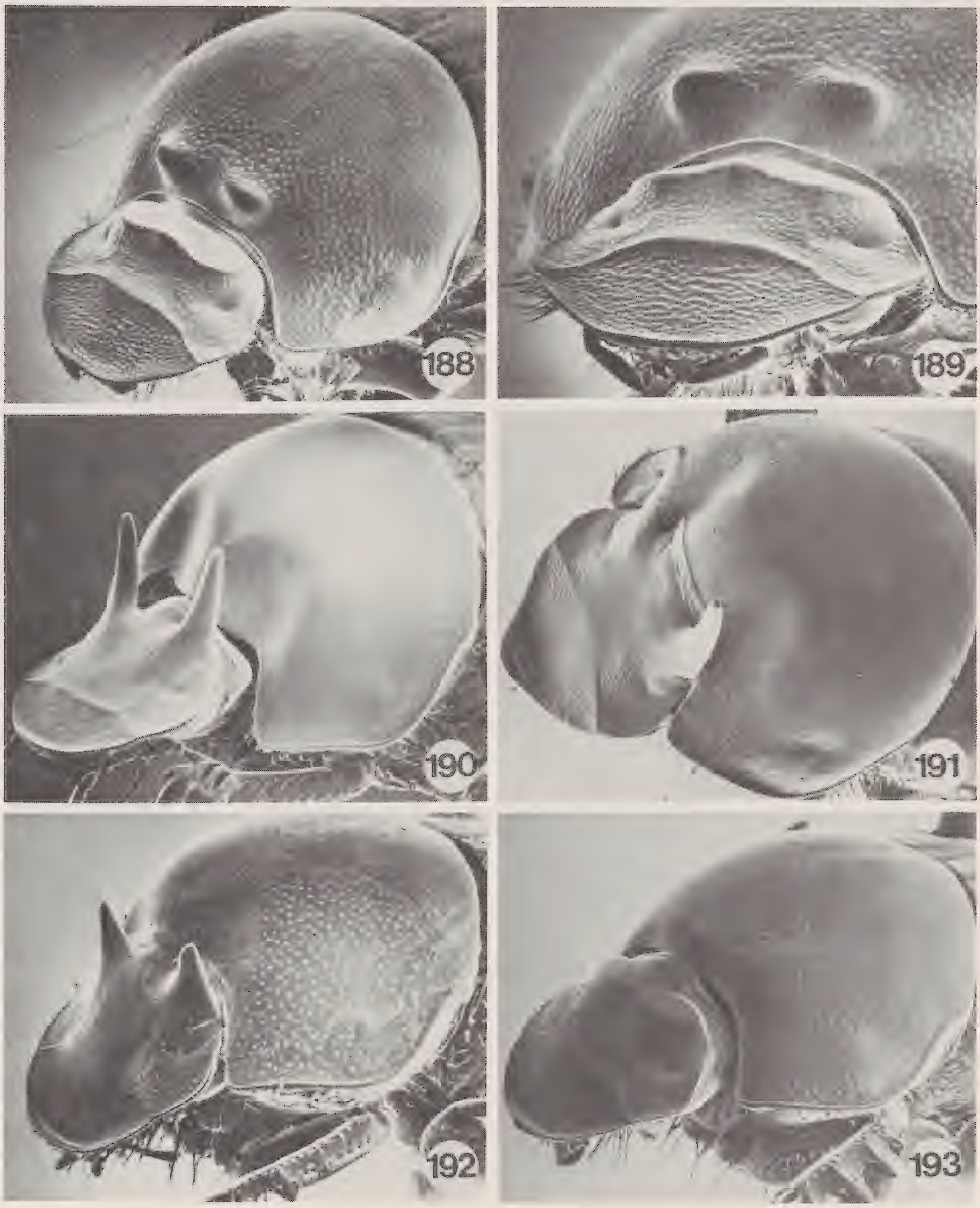
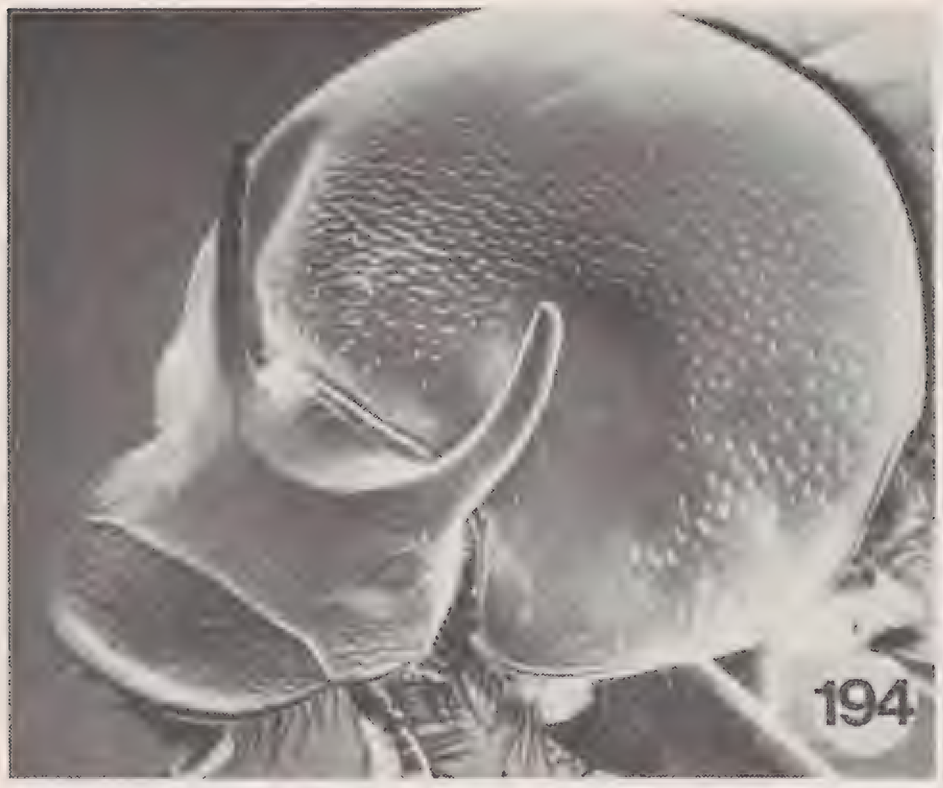
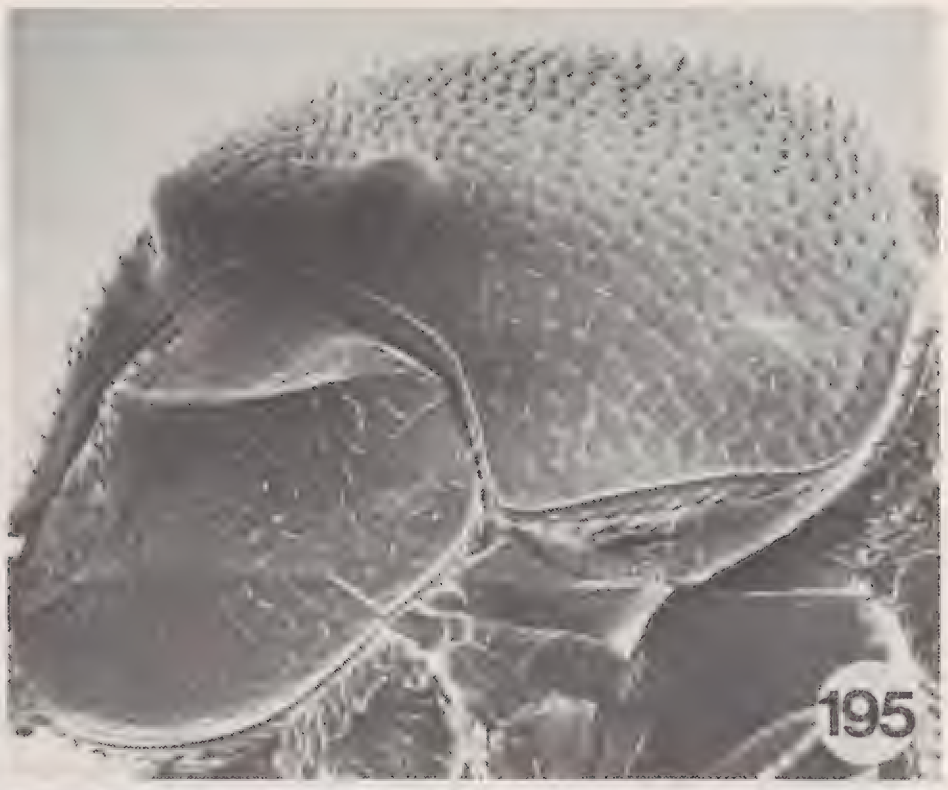
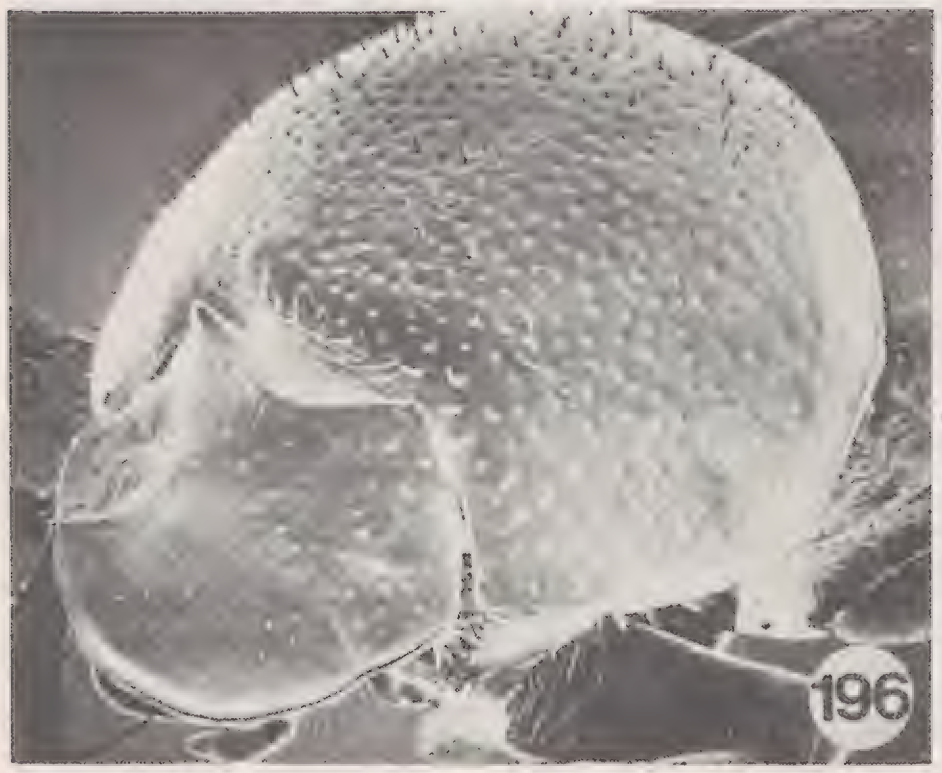
Fig. 182. Canthidium hespenheidei n. sp., male genitalia, dorsal view. Figs. 183-186. Onthophagus spp., male head and pronotum. 183. incensus Say. 184. batesi H. & C. 185. c. panamensis Bates. 186. stockwelli n. sp. Fig. 187. Onthophagus stockwelli n. sp., male fore tibia.

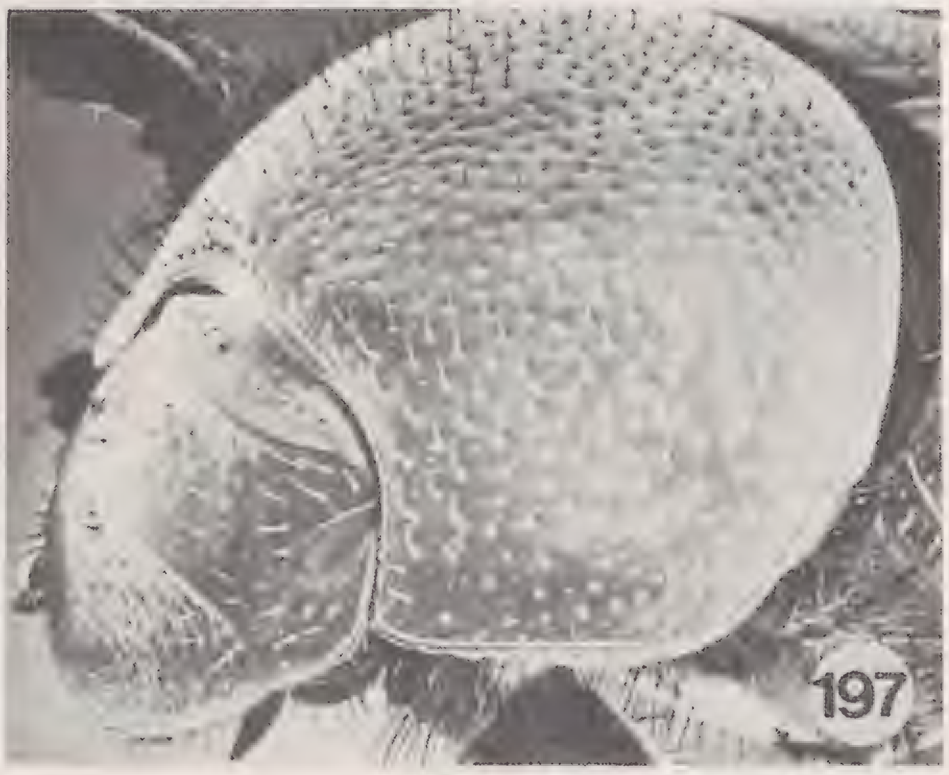


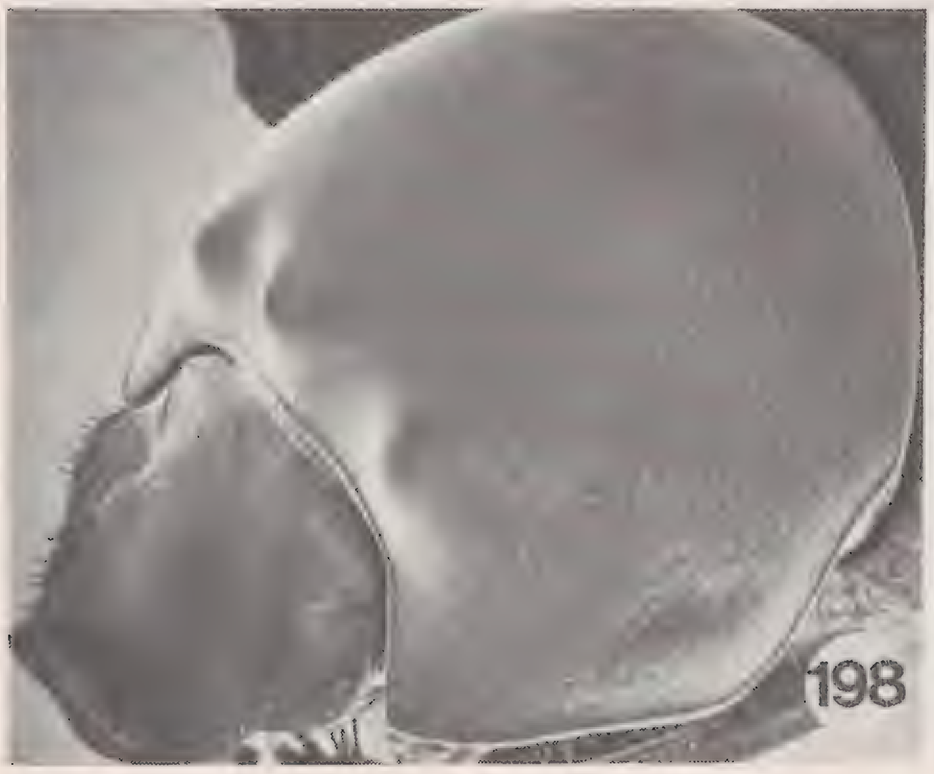
Figs. 188–193. *Onthophagus* spp., head and pronotum. 188, 189. *stockwelli* n. sp., female. 190. *nyctopus* Bates, male. 191. *acuminatus* Har., male. 192. *transisthmius* n. sp., male. 193. *transisthmius* n. sp., female.

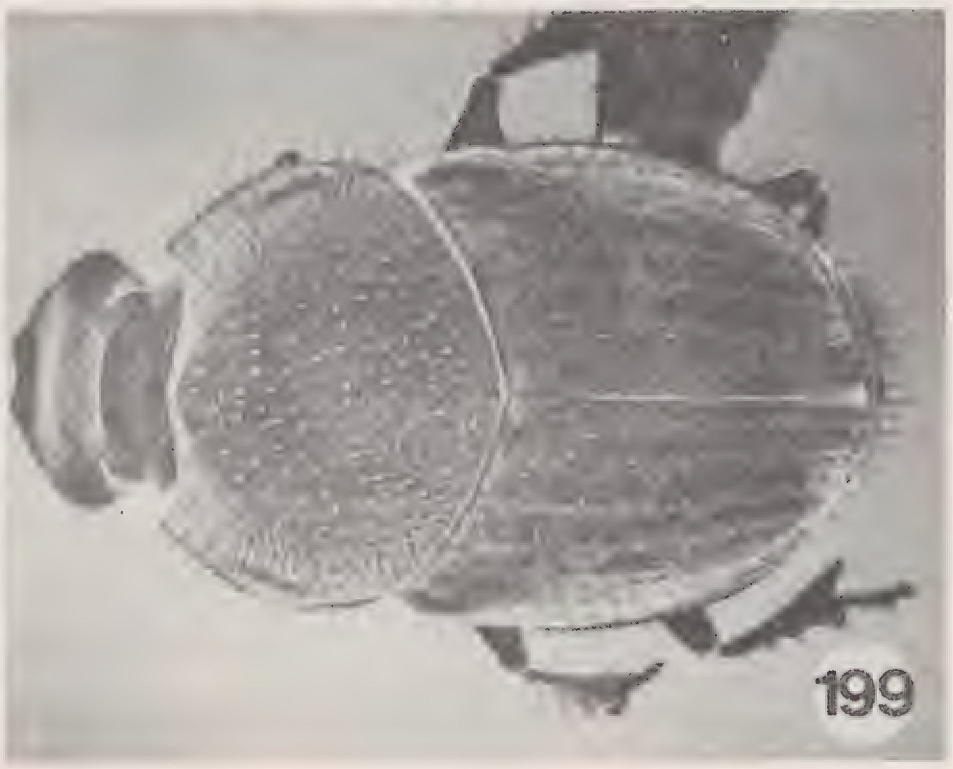




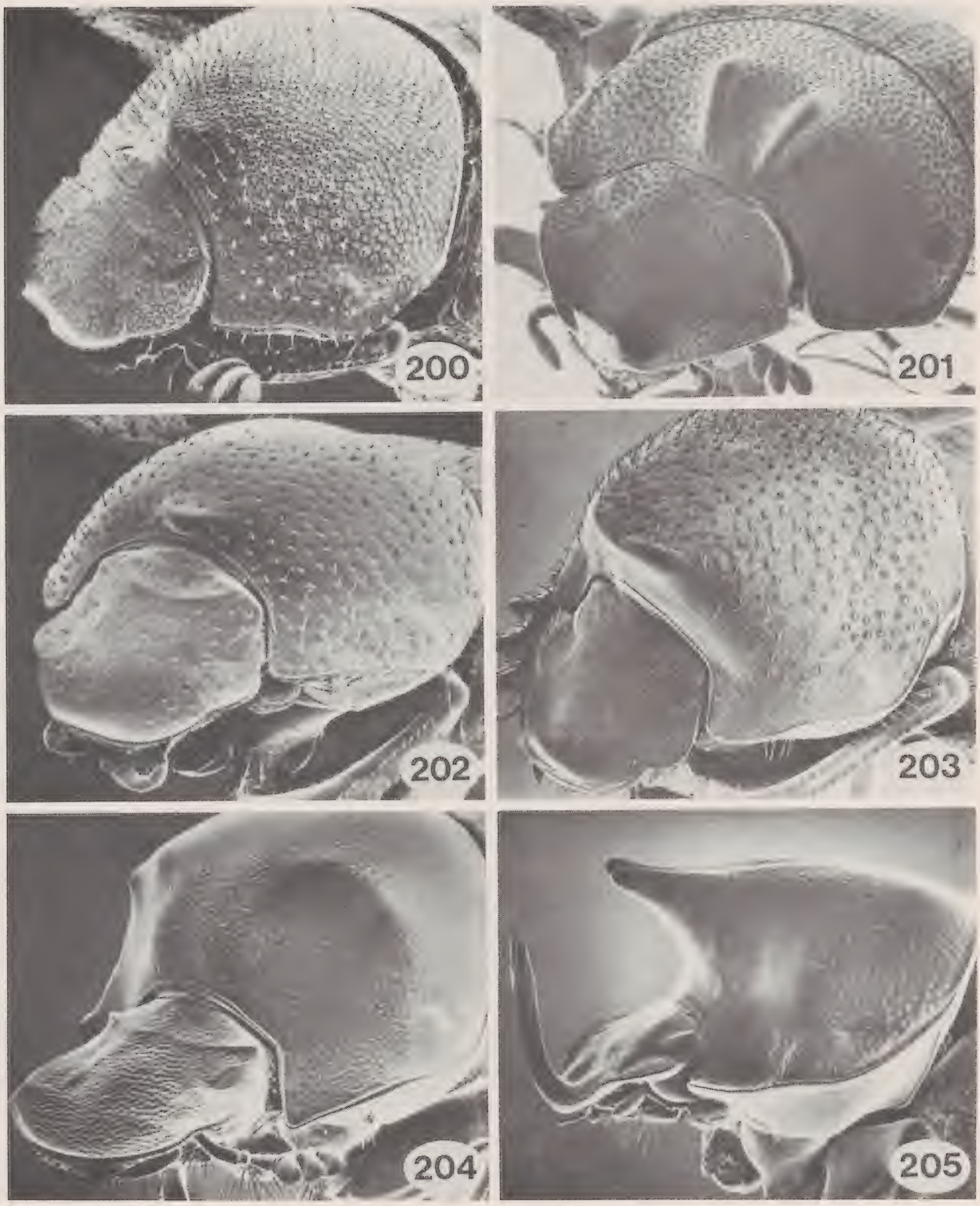




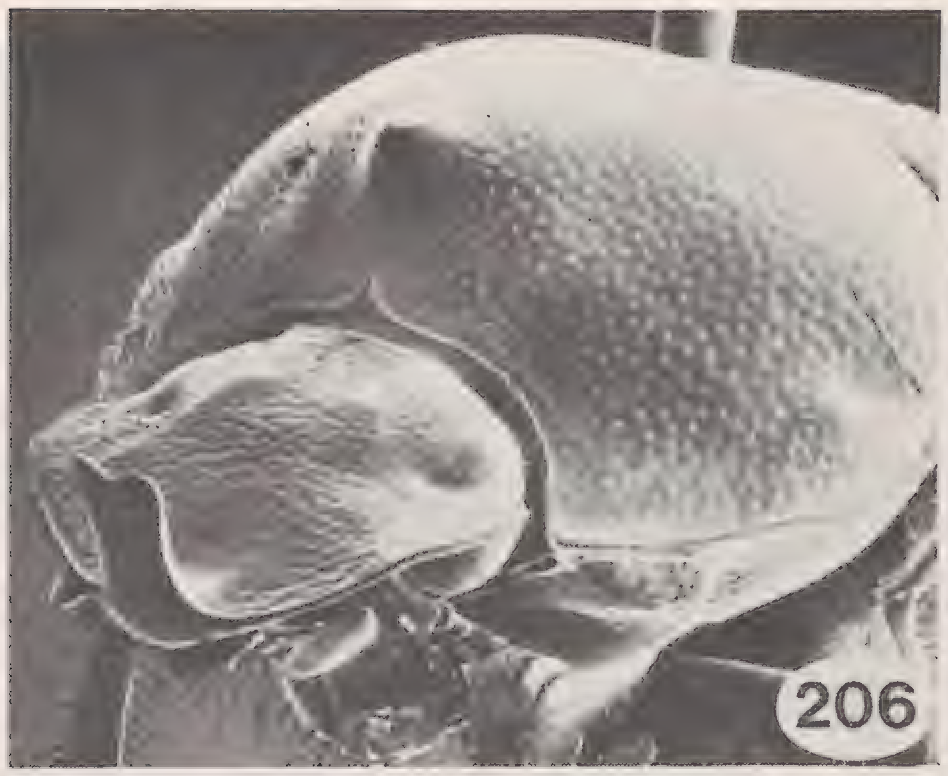




Figs. 194-198. *Onthophagus* spp., head and pronotum. 194. *marginicollis* Har., male. 195. *marginicollis* Har., female. 196. *lebasi* Bouc., male. 197. *lebasi* Bouc., female. 198. *chryses* Bates, male. Fig. 199. *Onthophagus coscineus* Bates, dorsum.



Figs. 200–205. *Onthophagus* spp., male head and pronotum. 200. *coscineus* Bates. 201. *dicranius* Bates. 202. *landolti* Har. 203. *atrosericeus* Bouc. 204. *cyanellus* Bates. 205. *mirabilis* Bates, male, major form.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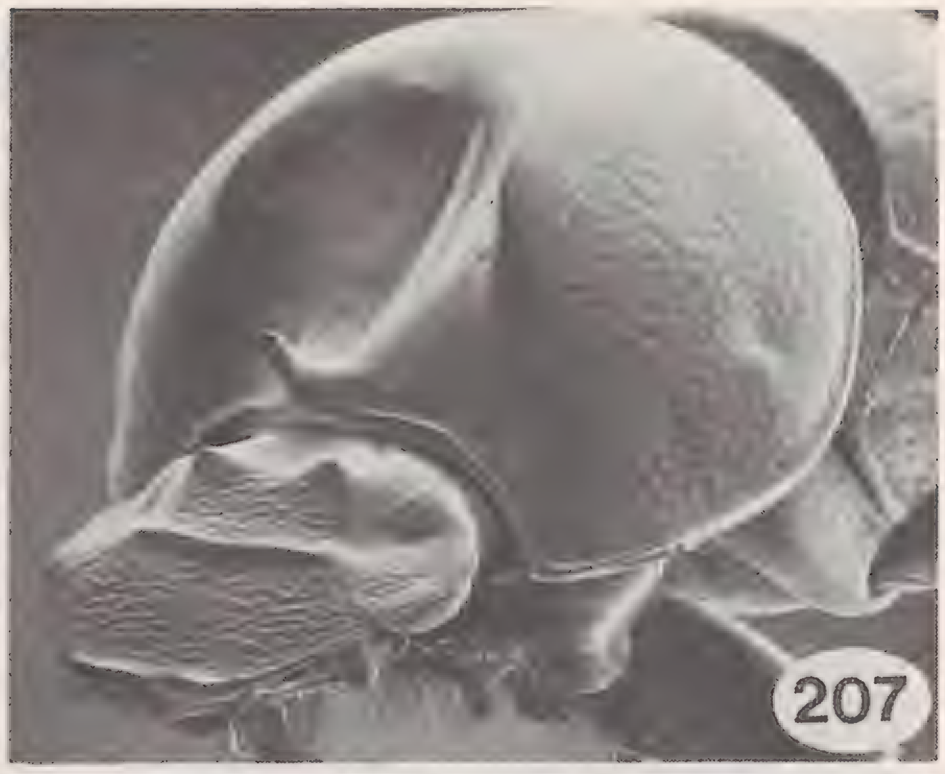
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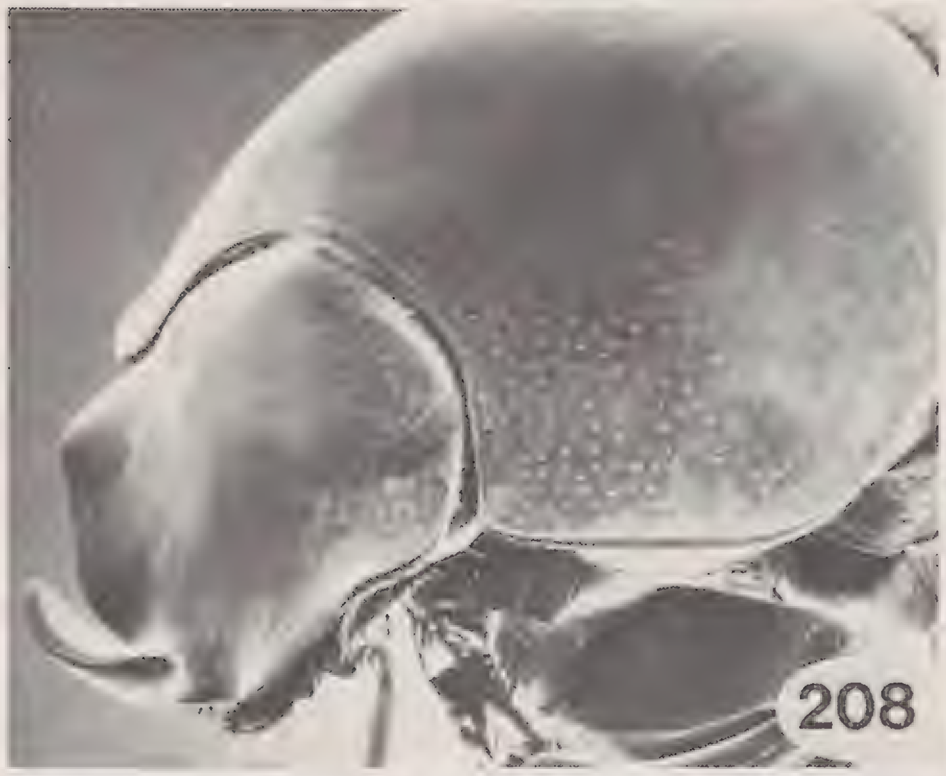
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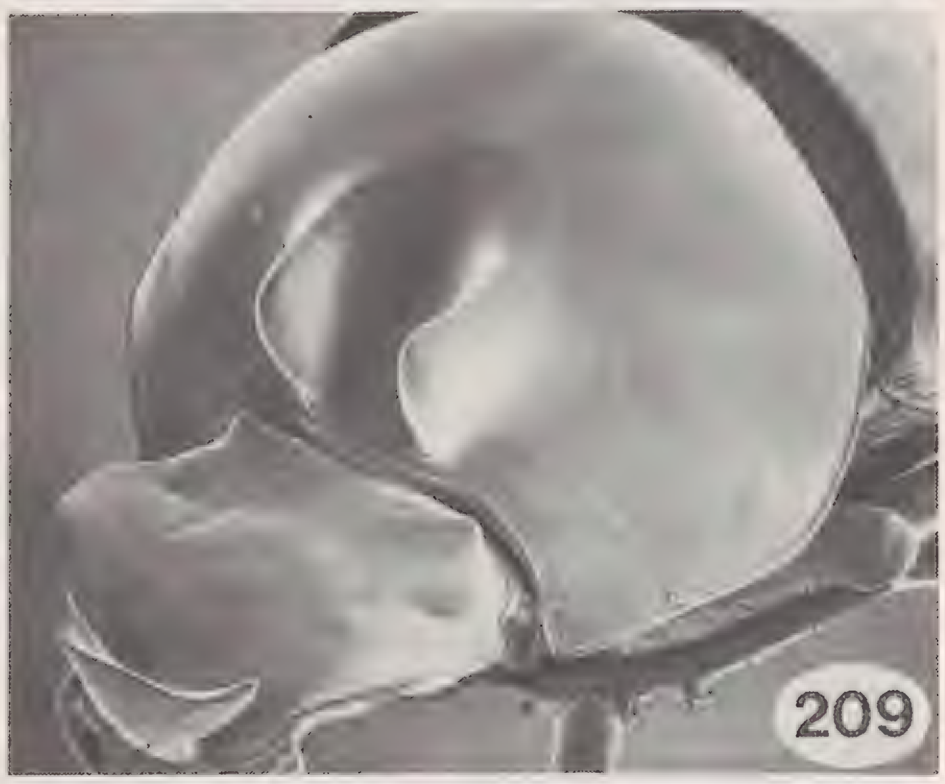
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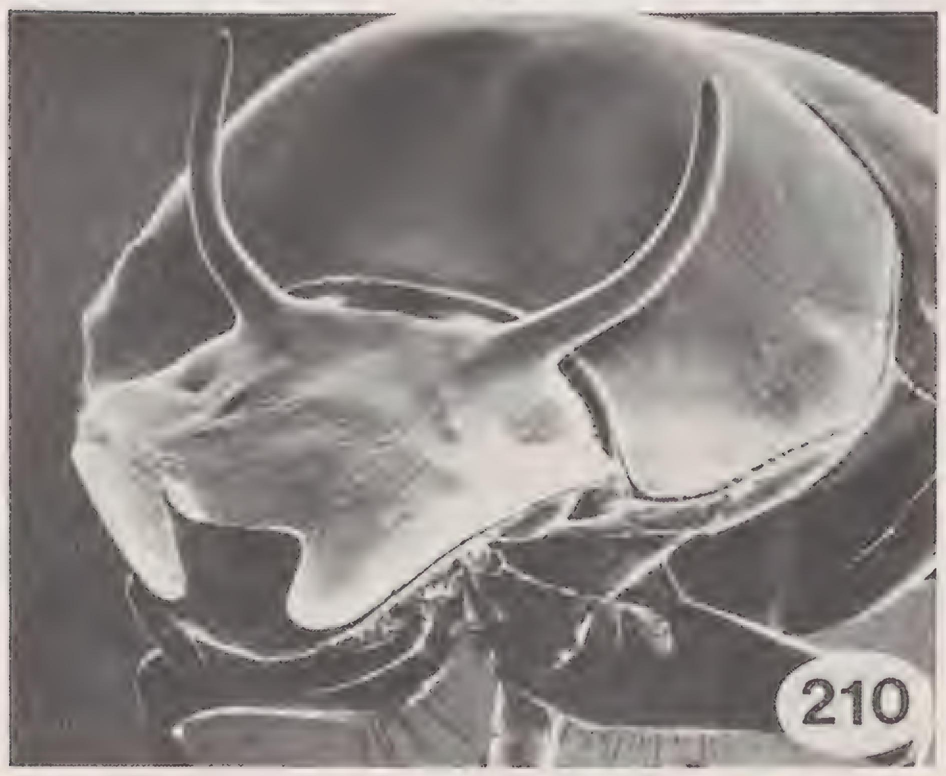
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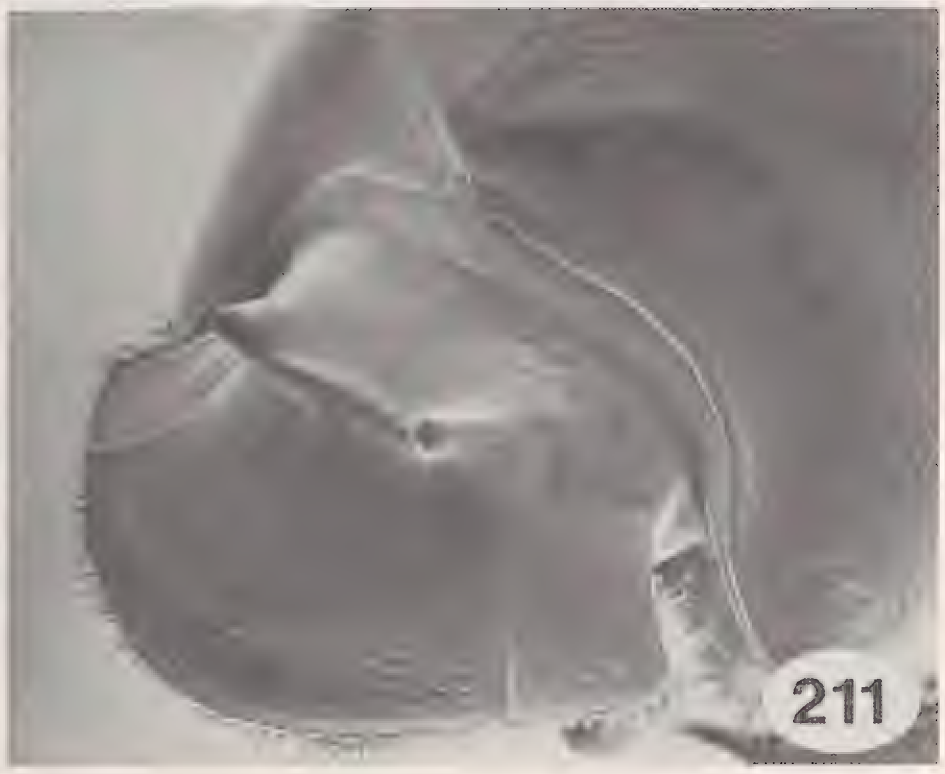
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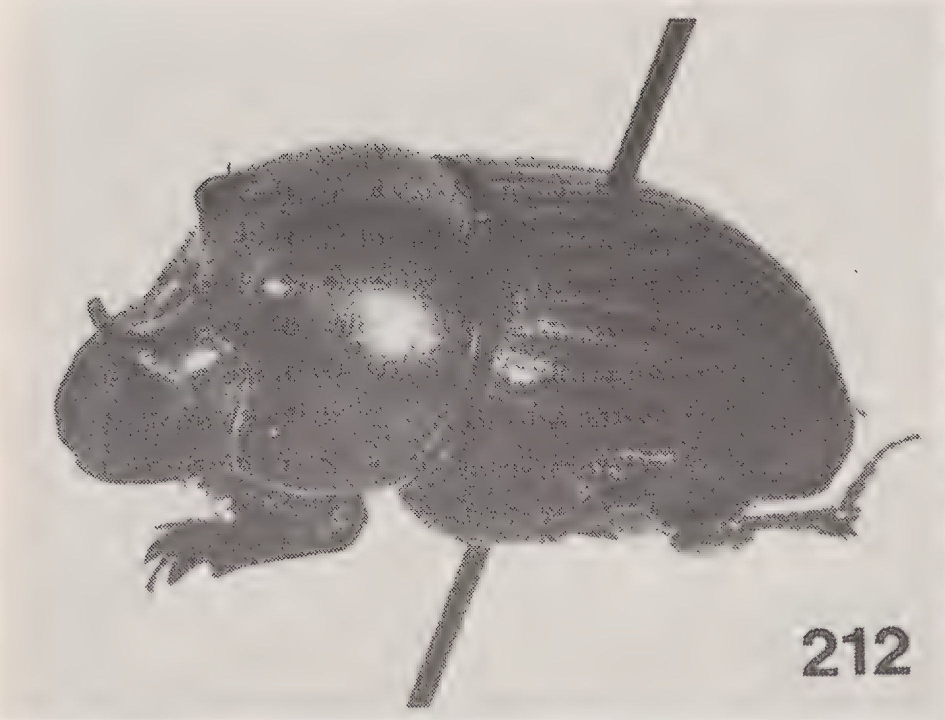
Figs. 206-210. Onthophagus spp., head and pronotum. 206. mirabilis Bates, male, minor form. 207. mirabilis Bates, female. 208. sharpi Har., male. 209. praecellens Bates, male. 210. belorhinus Bates, male. Fig. 211. Ontherus brevipennis Har., head.



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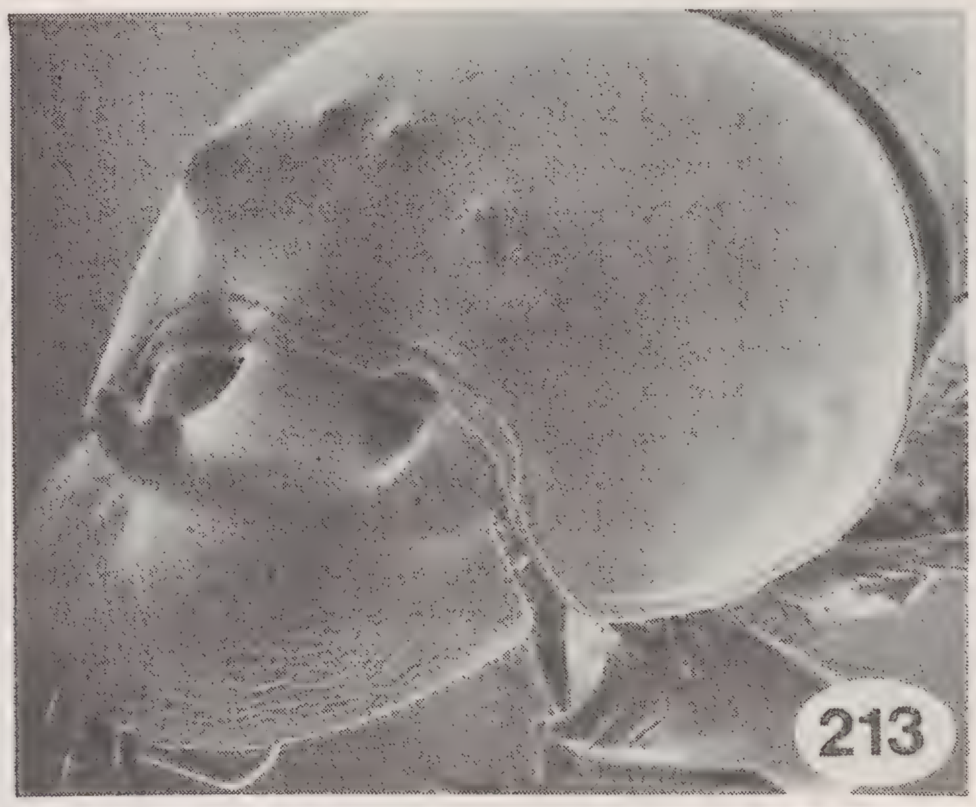

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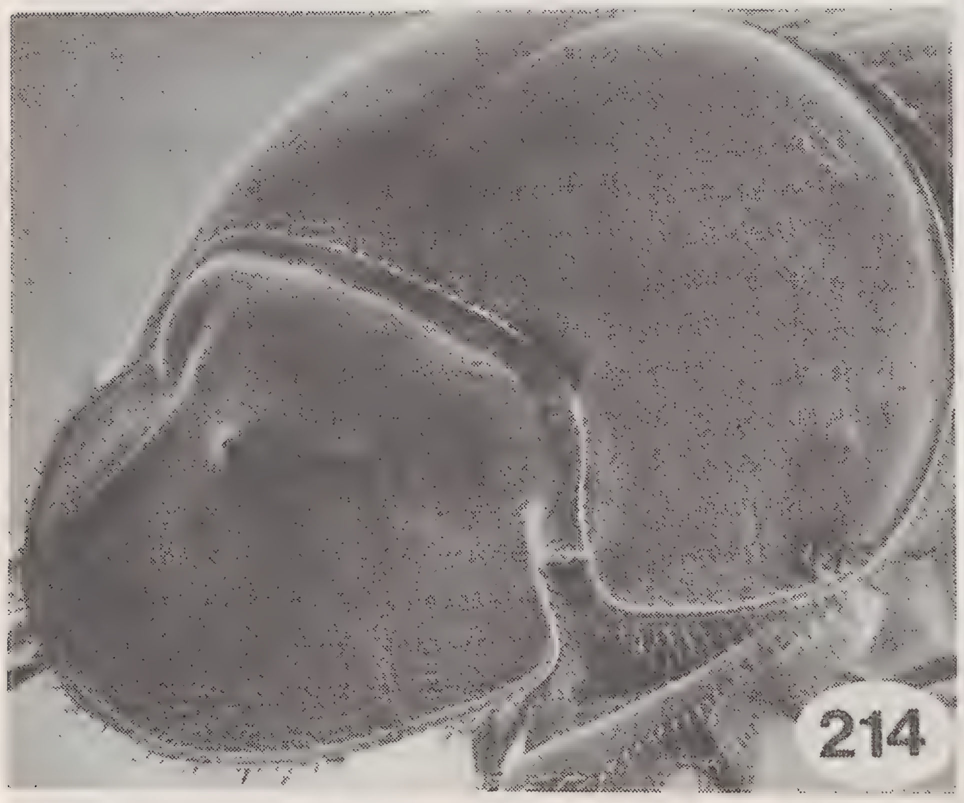

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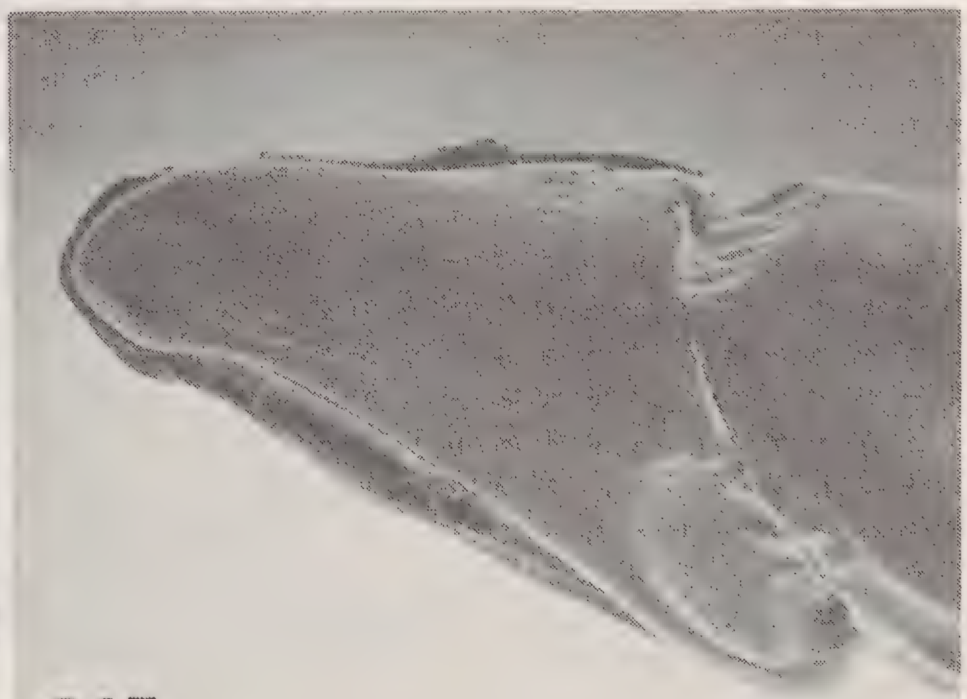

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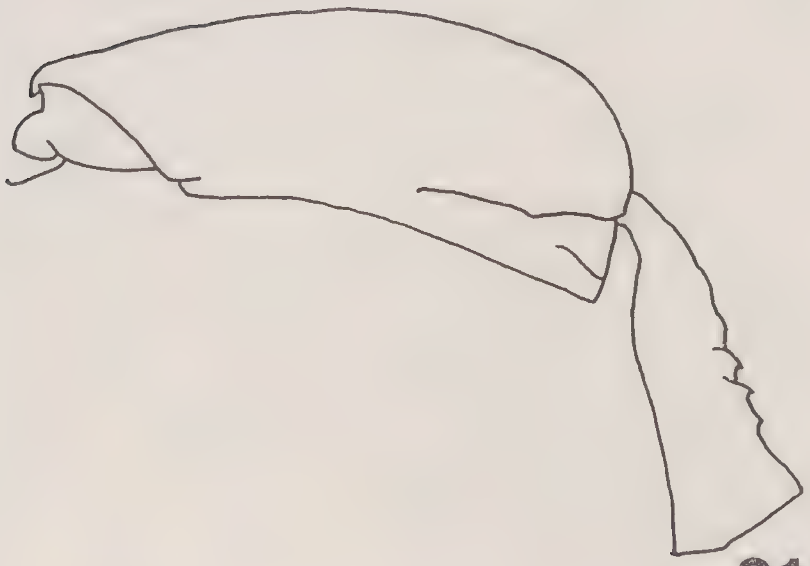

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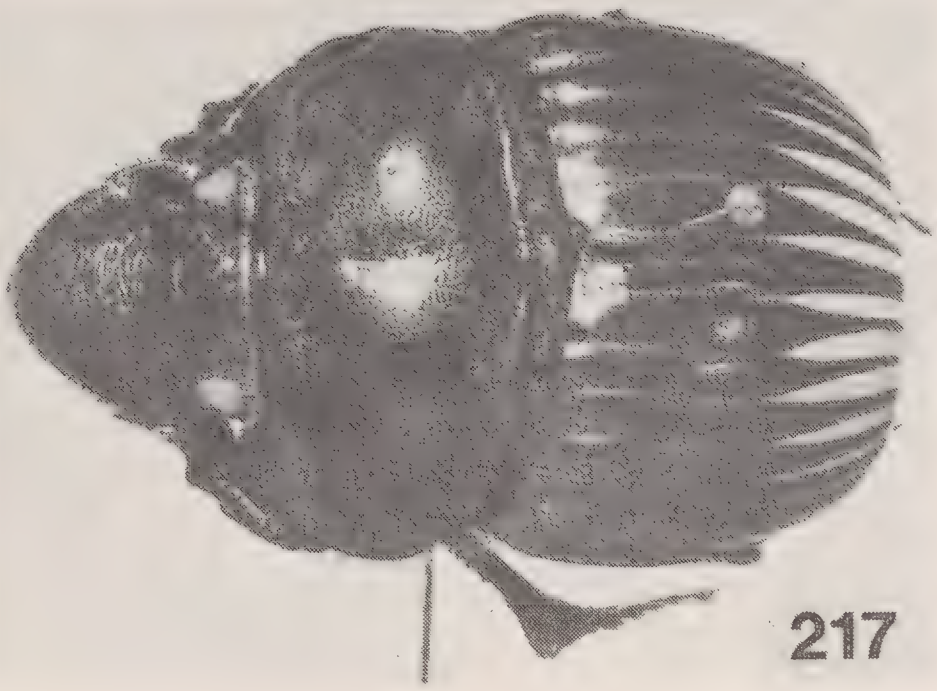

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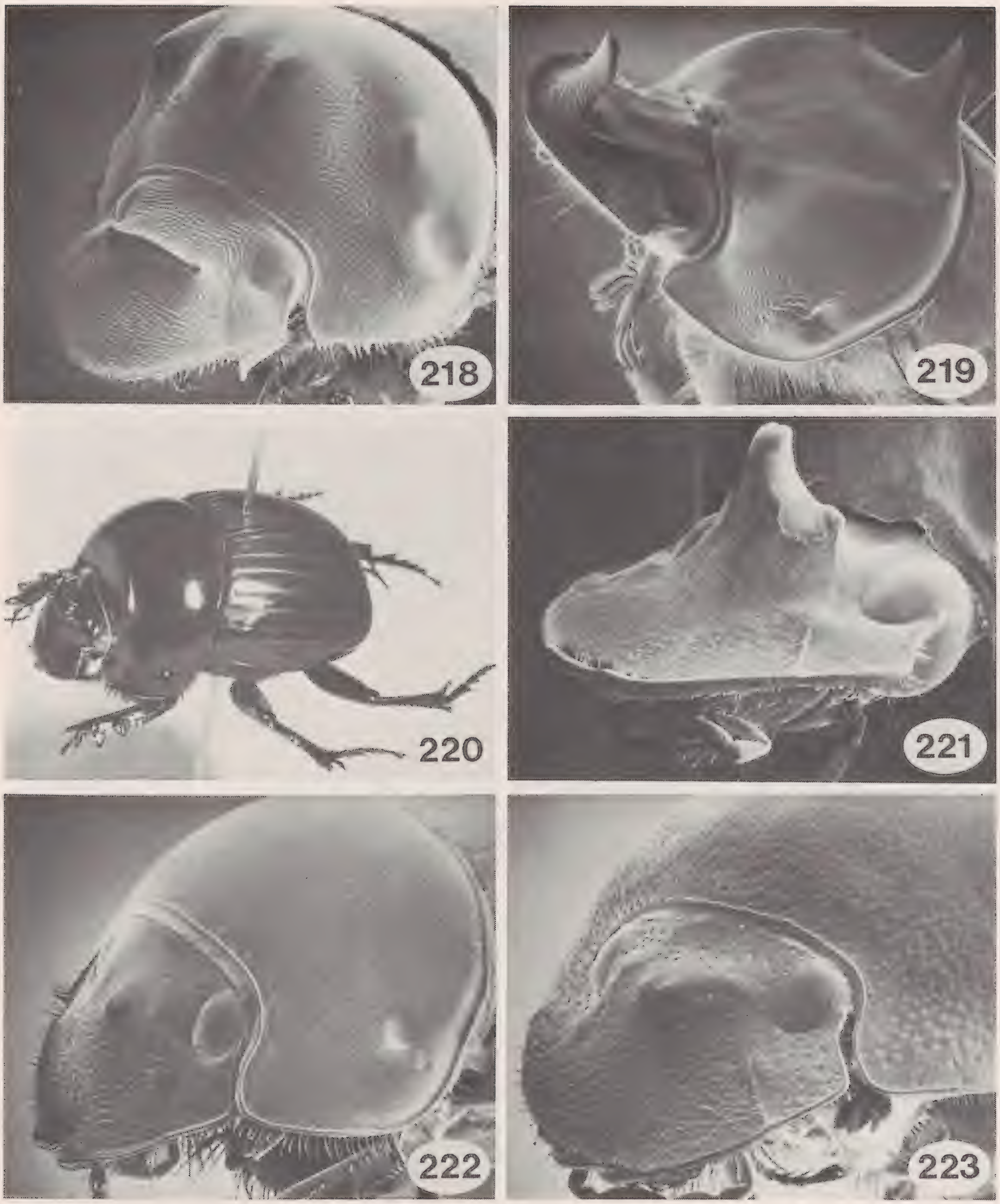
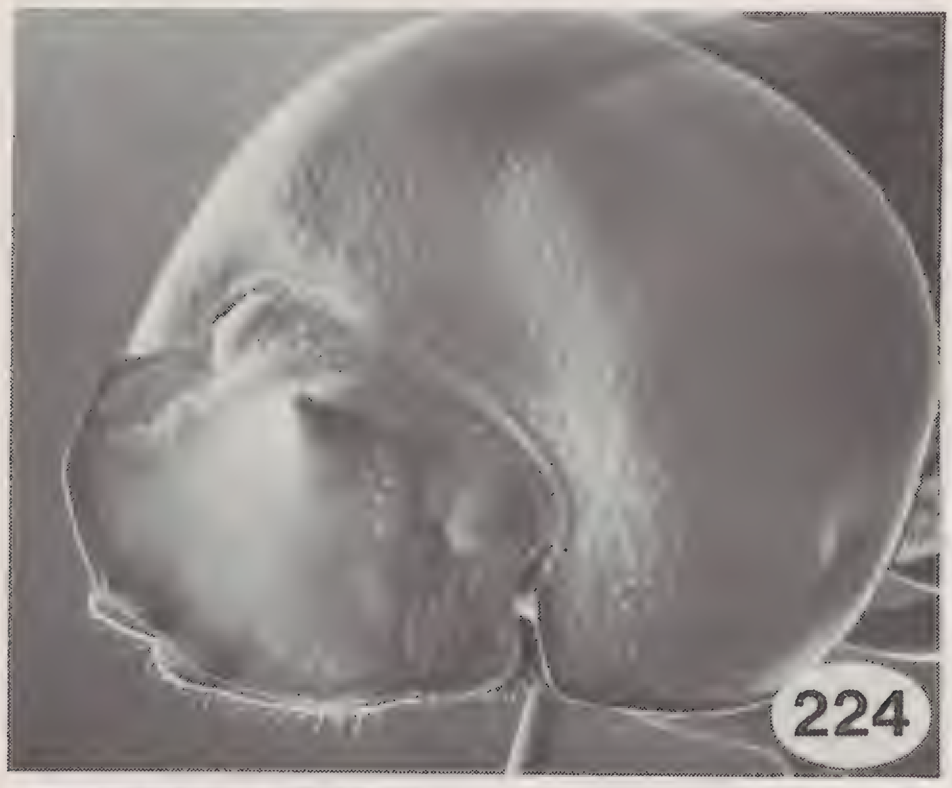
Figs. 212, 213. Ontherus didymus Er., male. 212. Dorsum. 213. Head and pronotum. Figs. 214-216. Ontherus strius n. sp., male. 214. Head and pronotum. 215. Male genitalia, lateral view. 216. Hind femur and tibia. Fig. 217. Dichotomius c. colonicus (Say), dorsum.



Figs. 218-223. *Dichotomius* spp. 218. *nevermanni* (Lued.), female. 219. *satanas* (Har.), male. 220. *agenor* (Har.), dorsum of male. 221. *agenor* (Har.), male head. 222. *inachus* (Er.), head and pronotum. 223. *femoratus* n. sp., head of female.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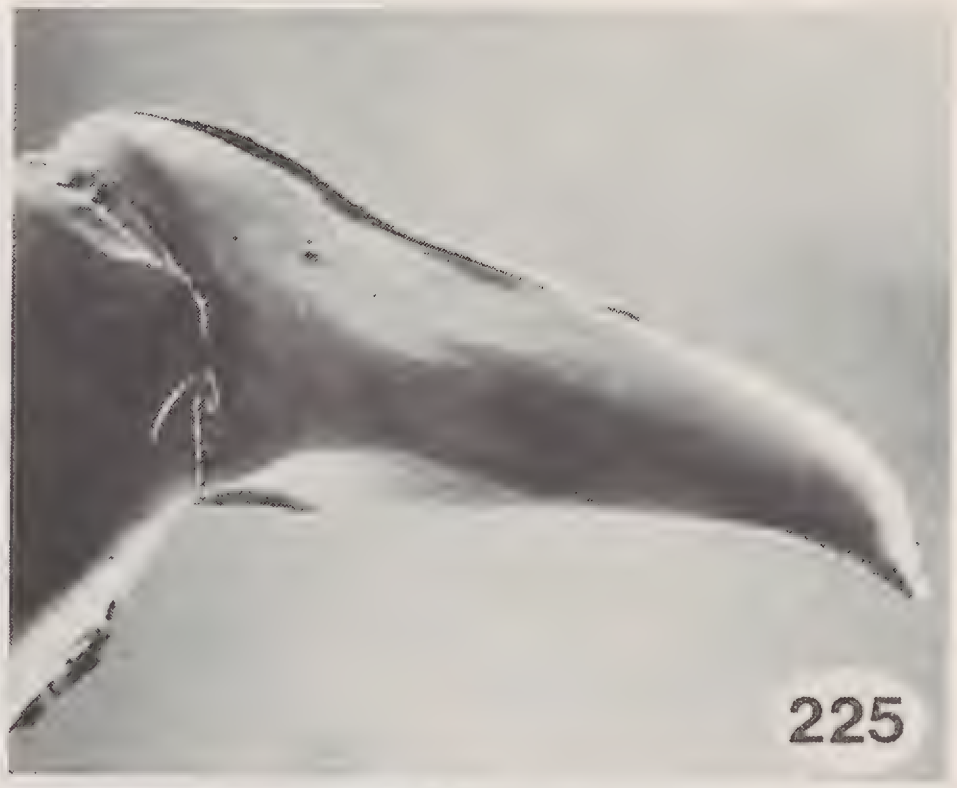
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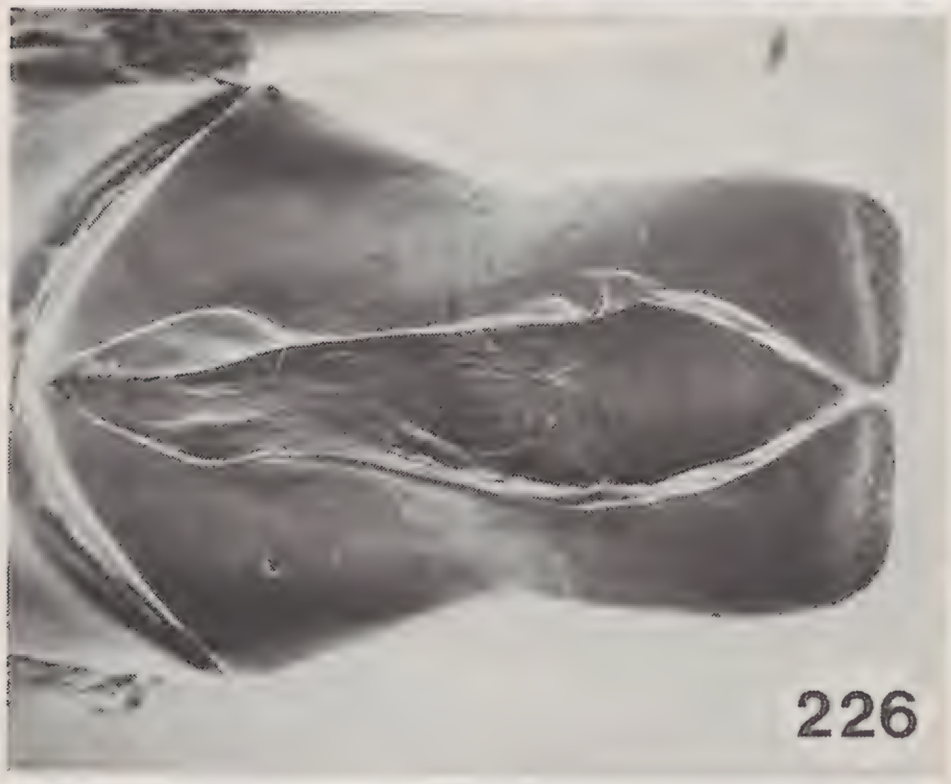
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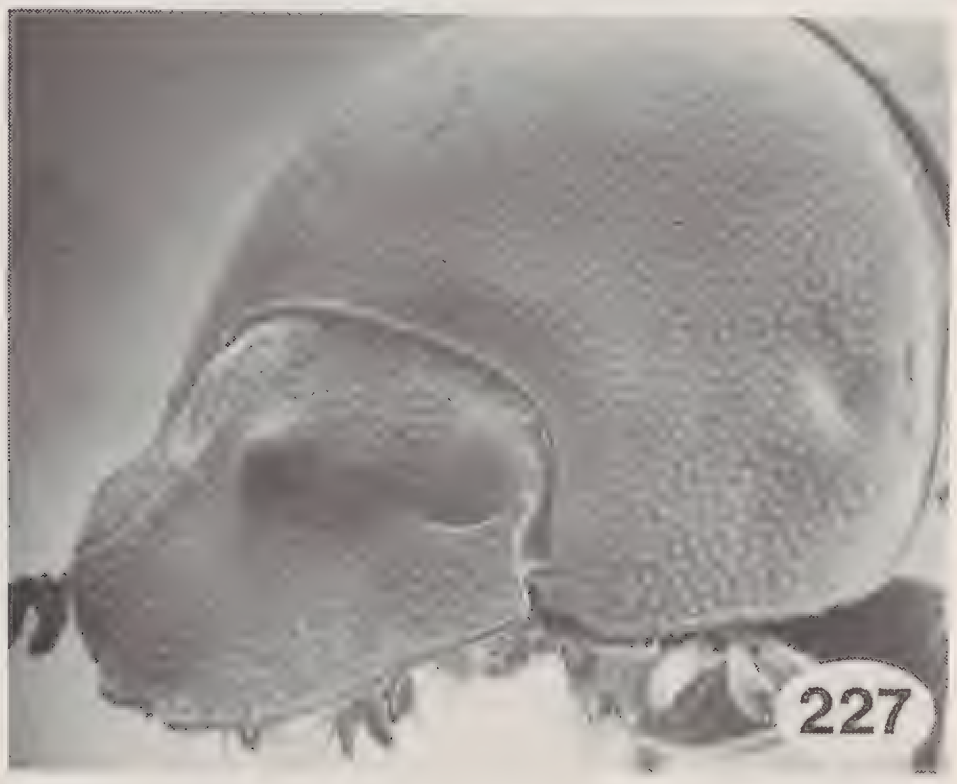
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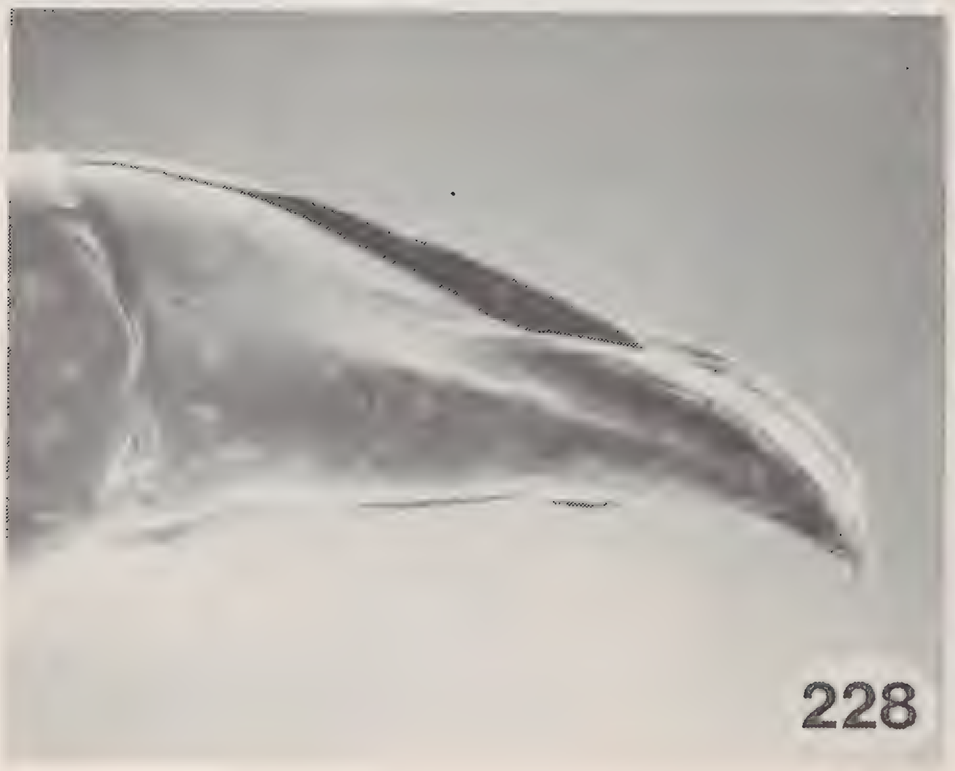
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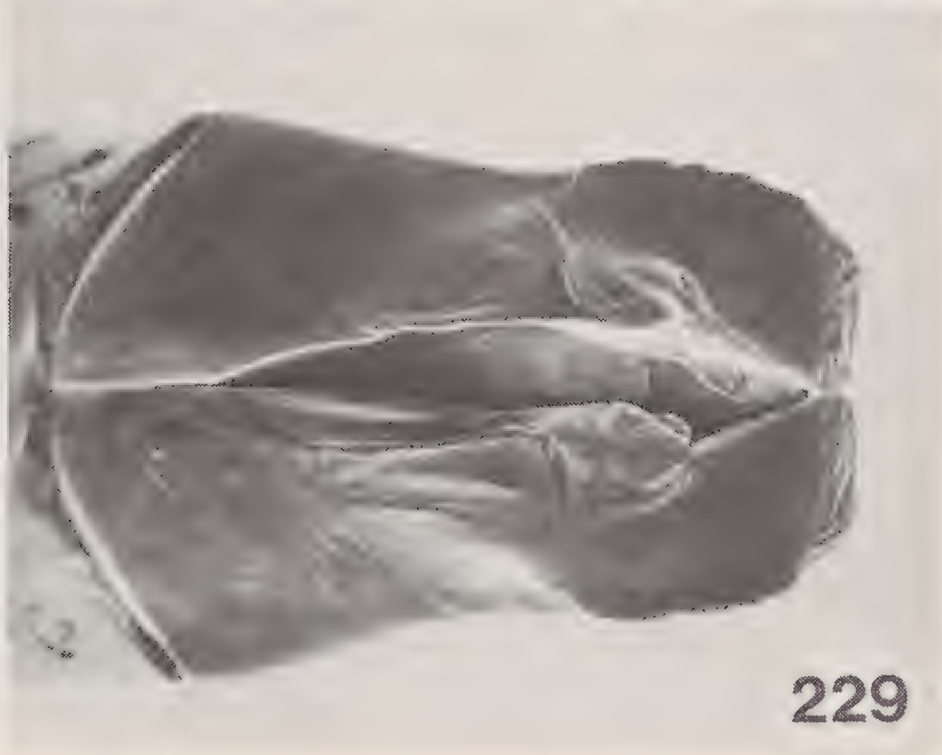
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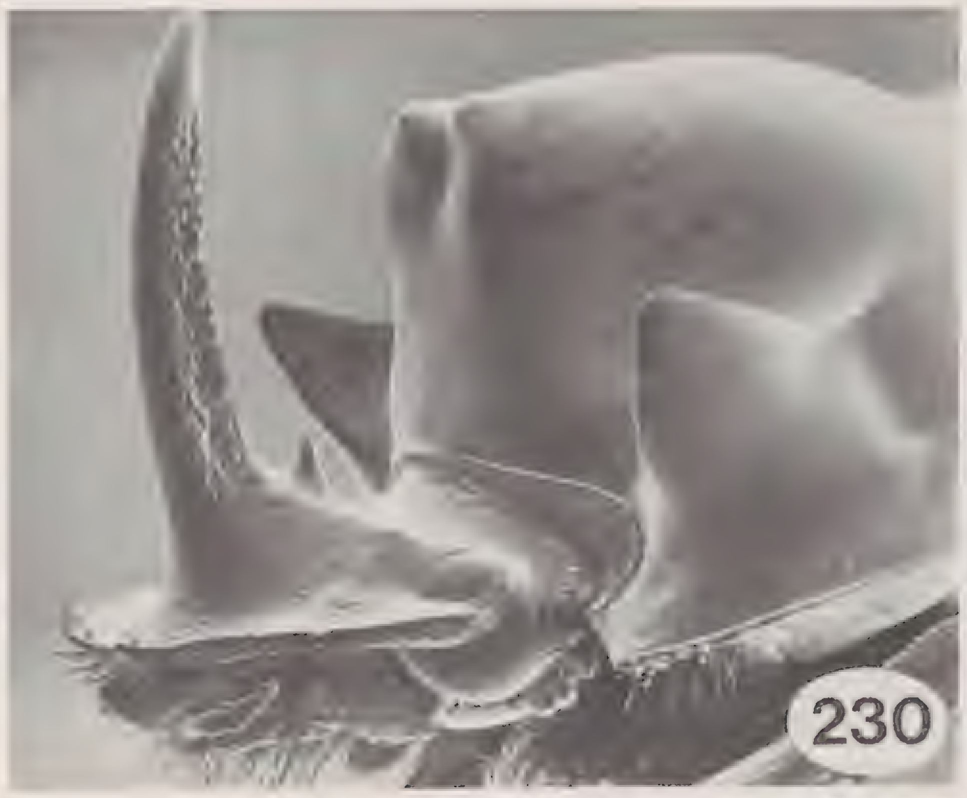
Figs. 224-226. *Dichotomius femoratus* n. sp., male. 224. Head and pronotum. 225. Male genitalia, lateral view. 226. Male genitalia, dorsal view. Figs. 227-229. *Dichotomius gamboaensis* n. sp., male. 227. Head and pronotum. 228. Male genitalia, lateral view. 229. Male genitalia, dorsal view.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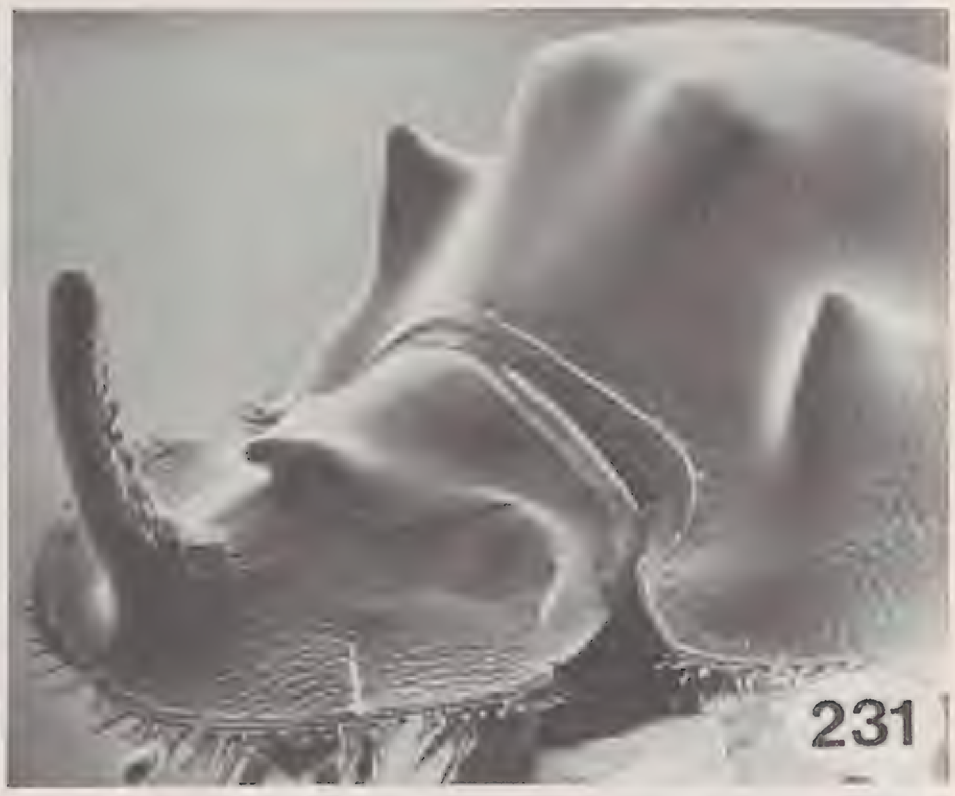
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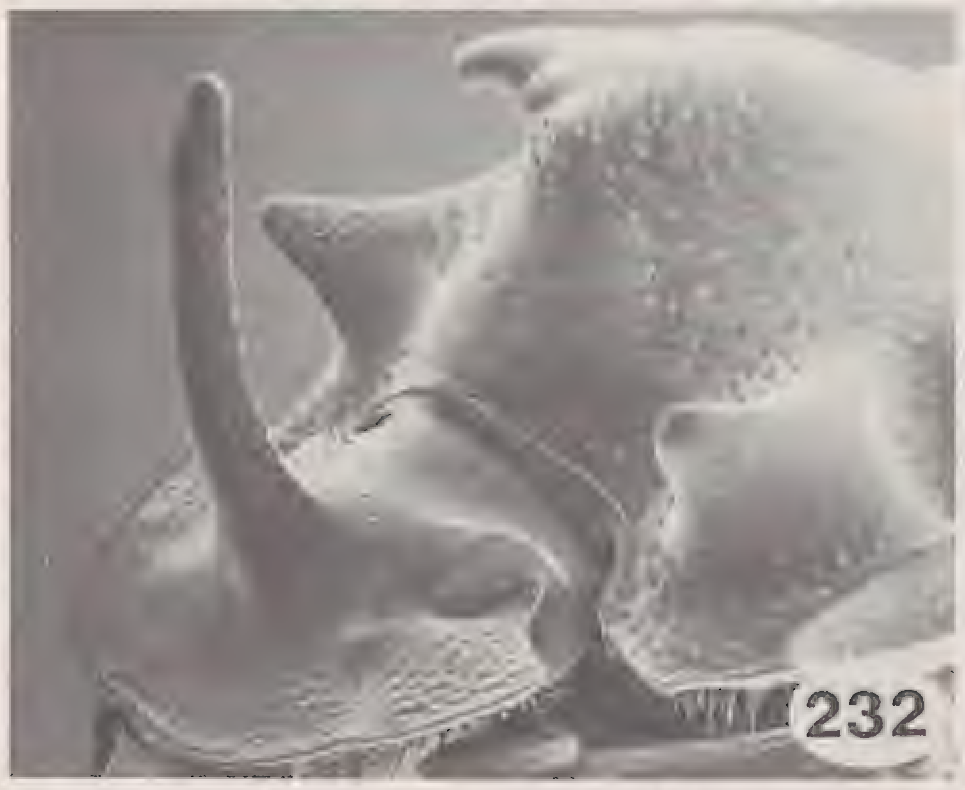
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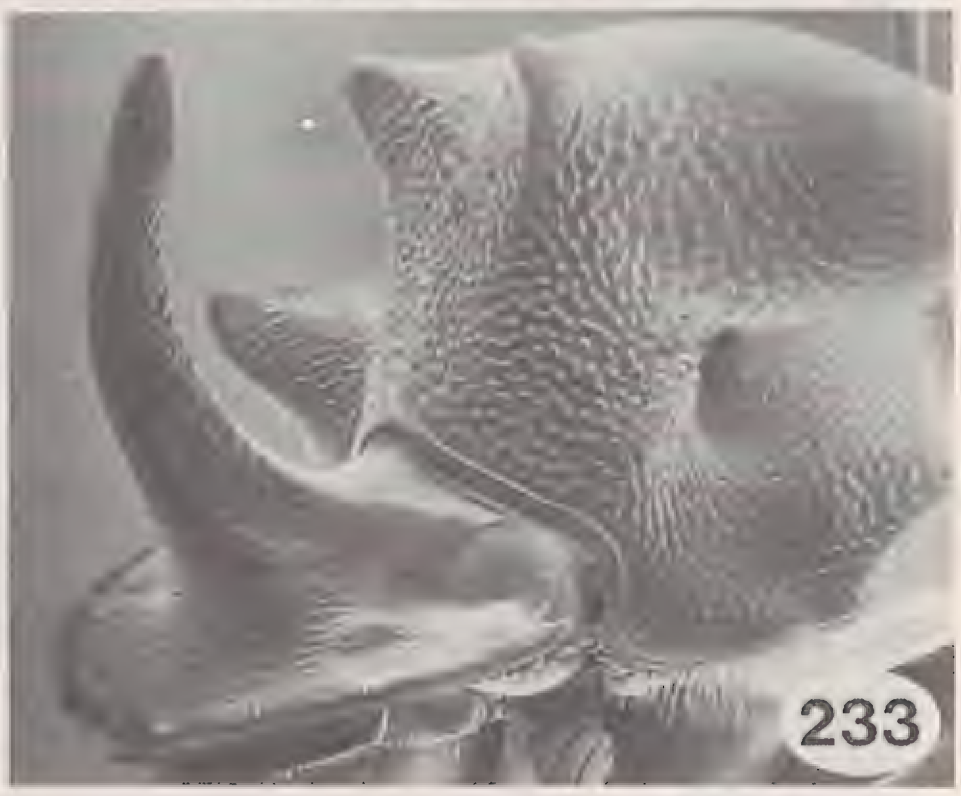
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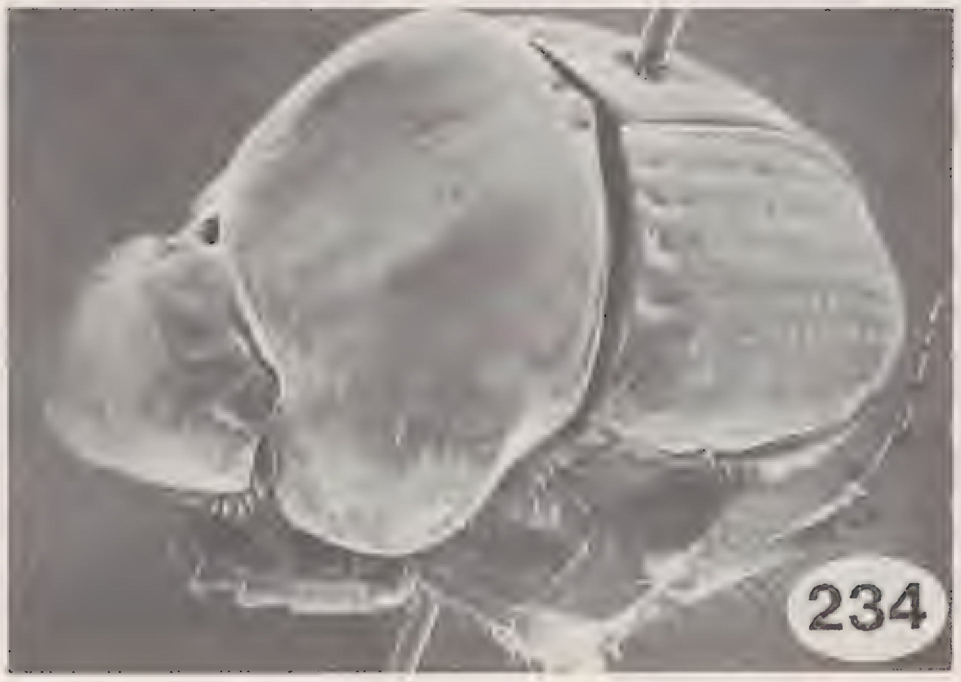
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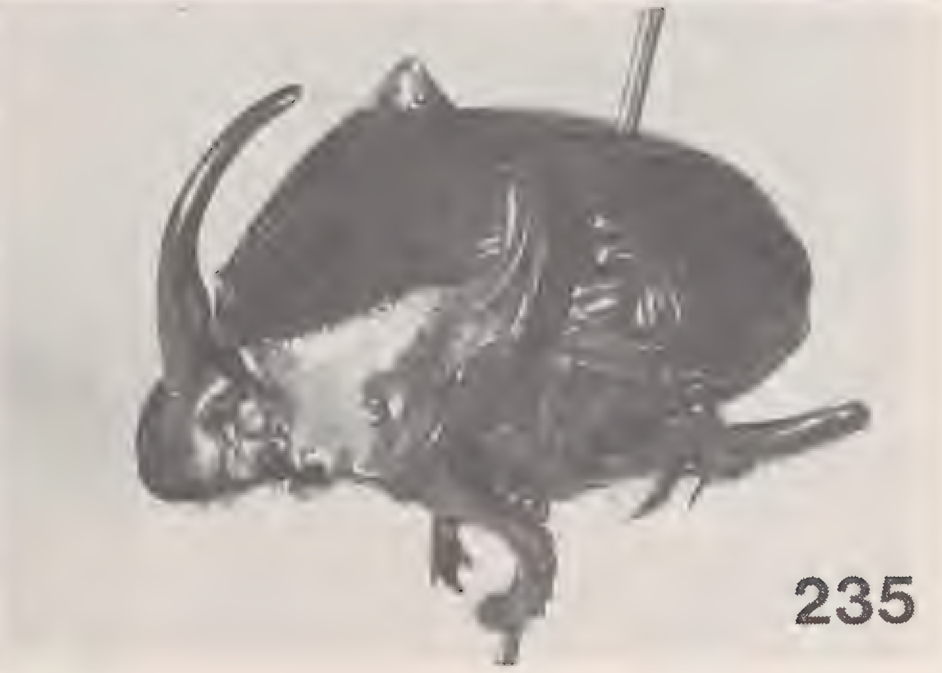
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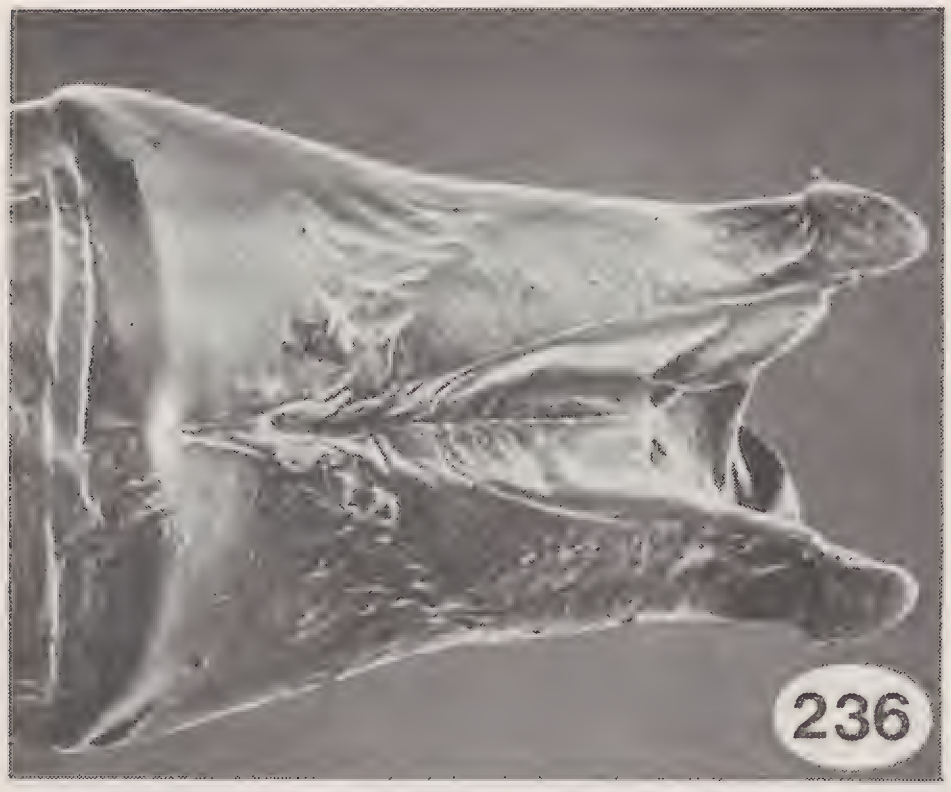
Figs. 230-233. Copris spp., male head and pronotum. 230. lugubris Boh. 231. incertus Say. 232. costaricensis Gahan. 233. subpunctatus Gill. figs. 234, 235. Phanaeus spp., male dorsum. 234. hermes Har., minor form. 235. beltianus Bates.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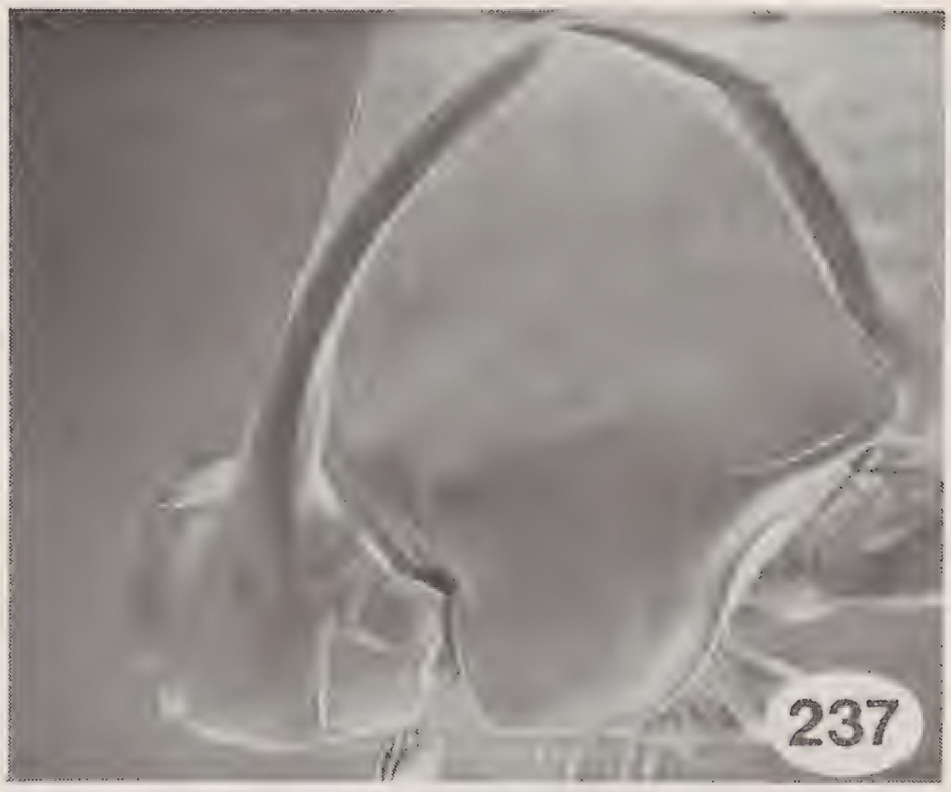
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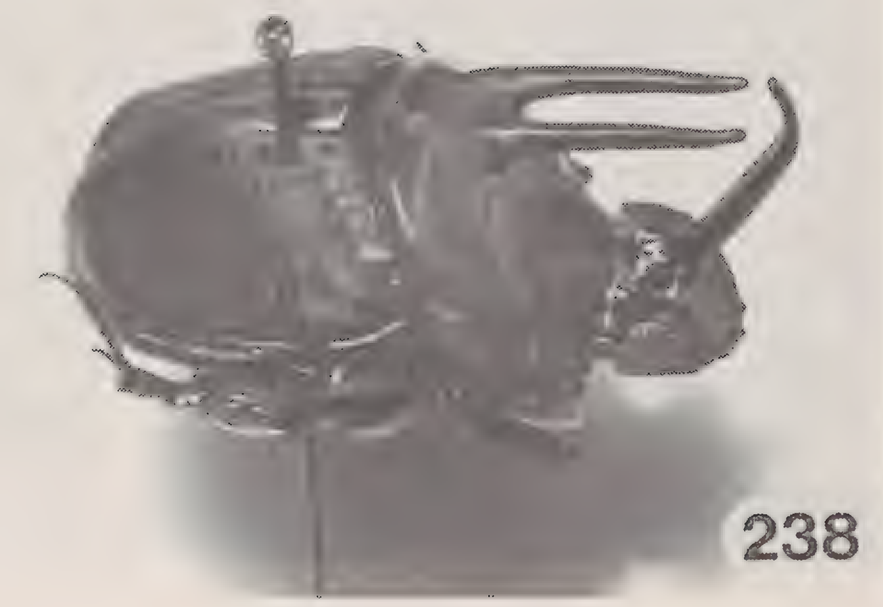
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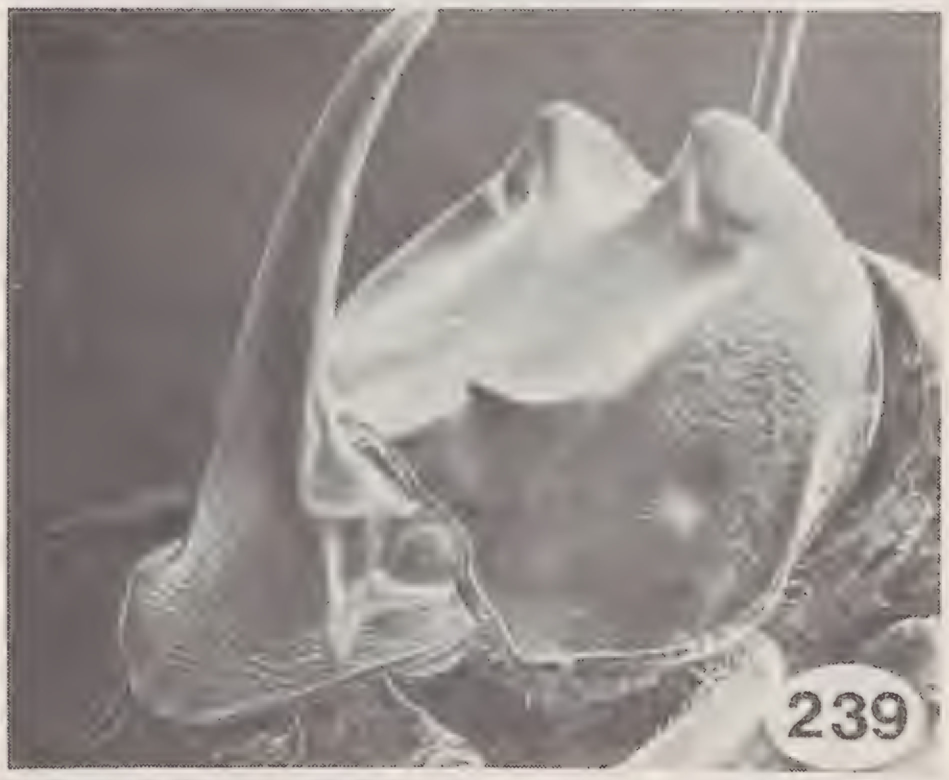
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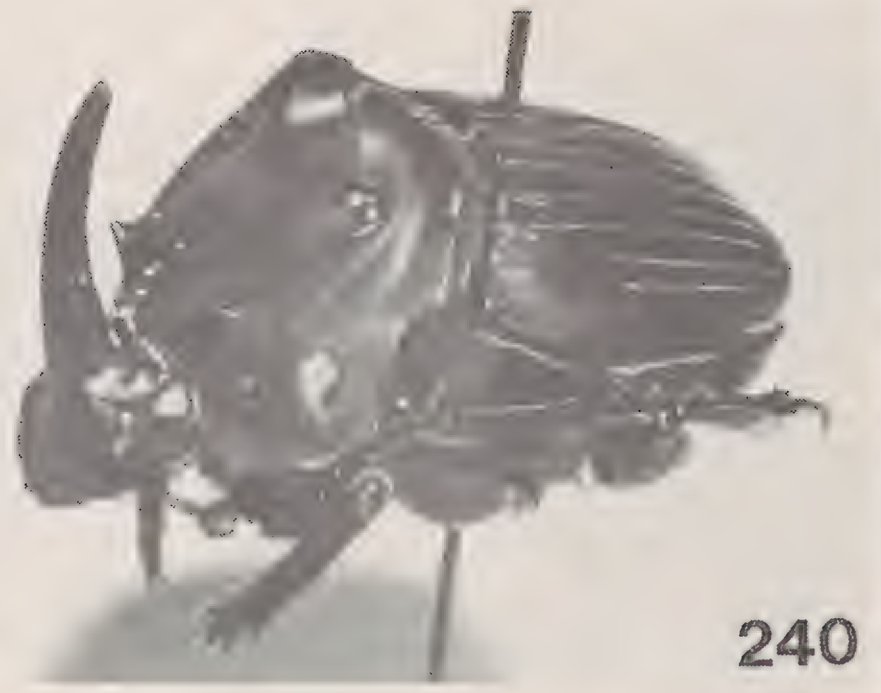
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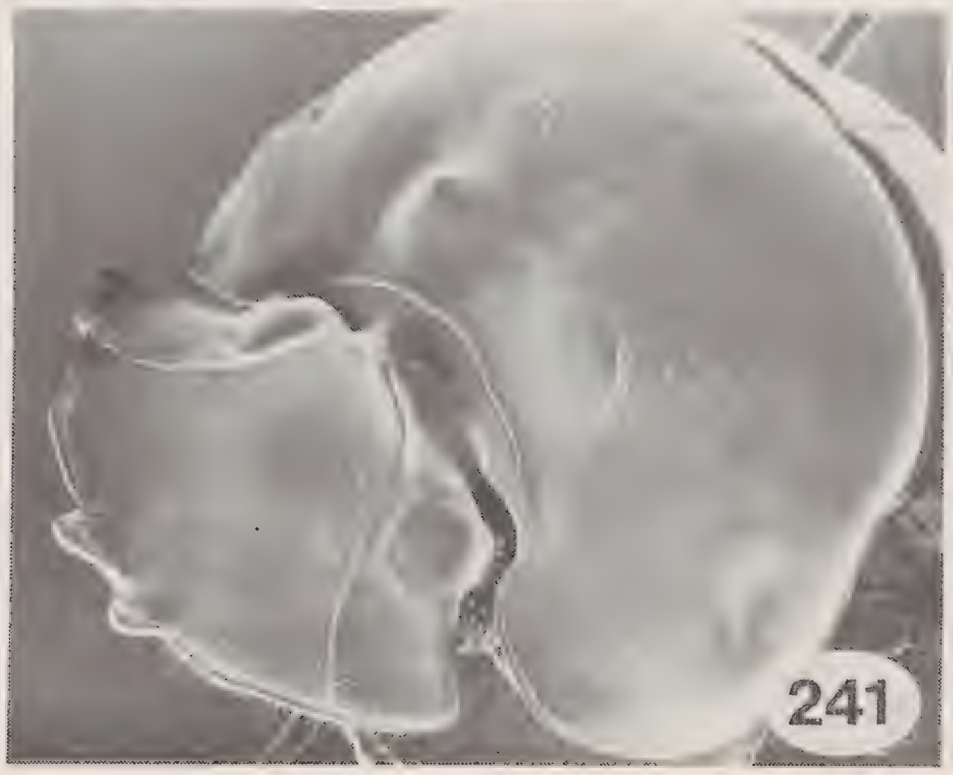
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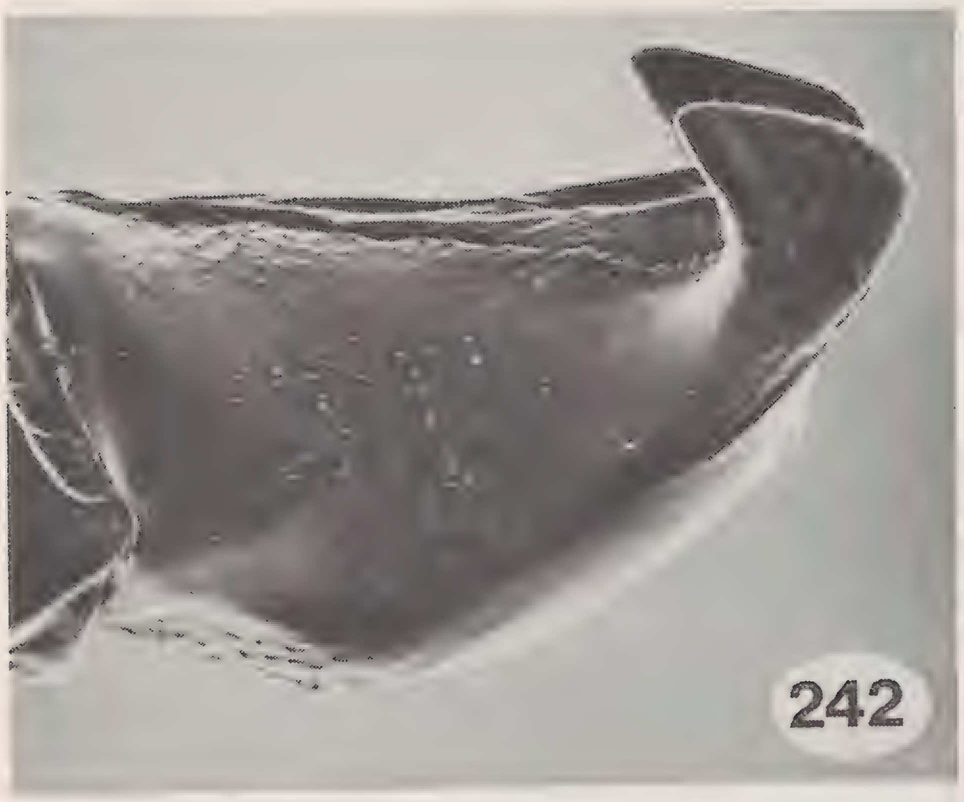
Figs. 236, 237. Phanaeus spp., male. 236. beltianus Bates, genitalia, dorsal view. 237. pyrois Bates, head and pronotum. Figs. 238-240. Sulcophanaeus spp., male. 238. velutinus (Murr.), dorsum. 239. cupricollis (Nev.), head and pronotum. 240. noctis (Bates), dorsum. Fig. 241. Coprophanaeus t. corythus (Har.), male head and pronotum.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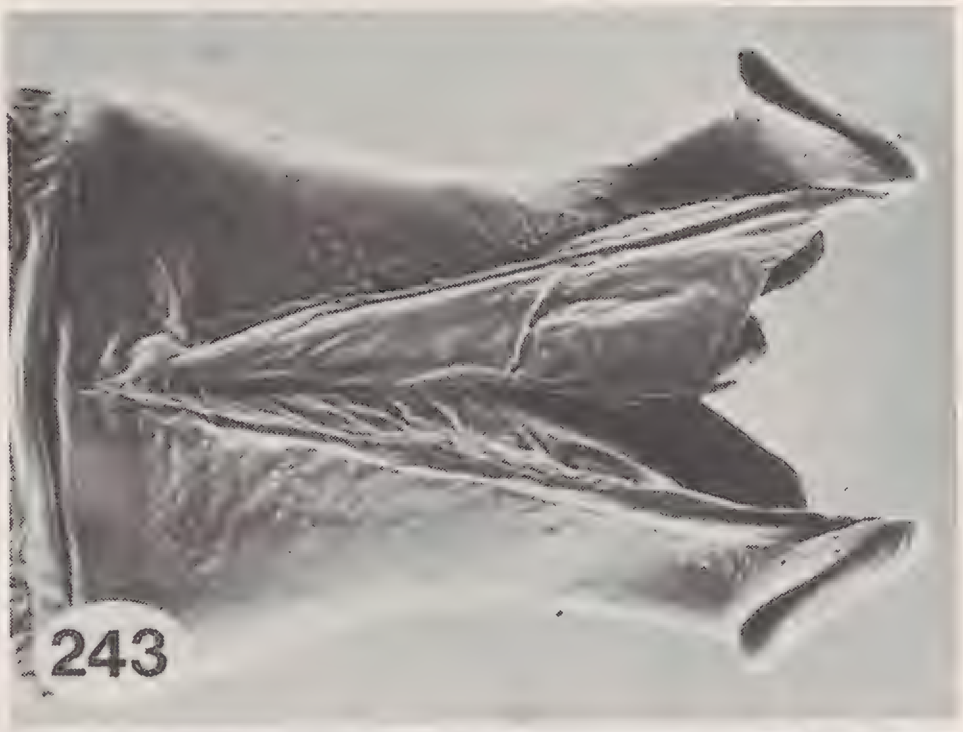
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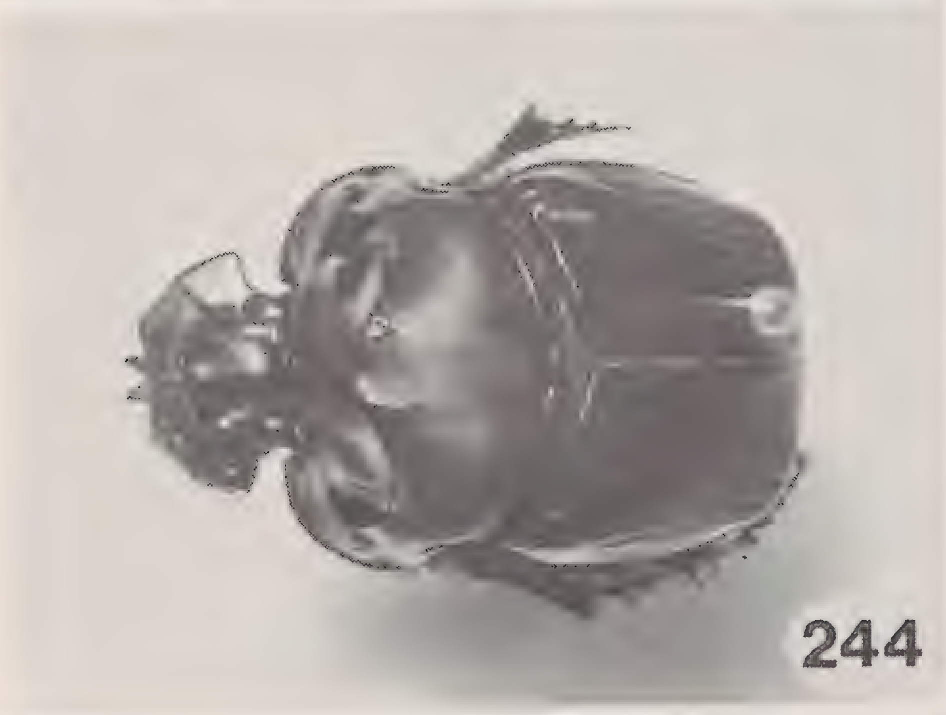
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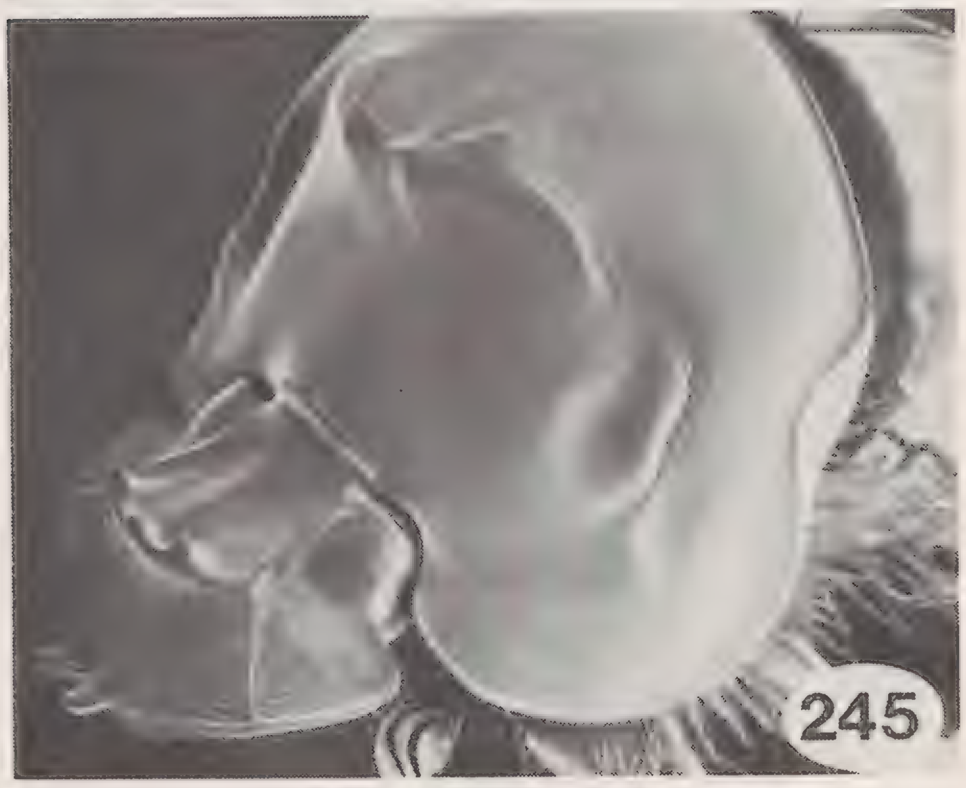
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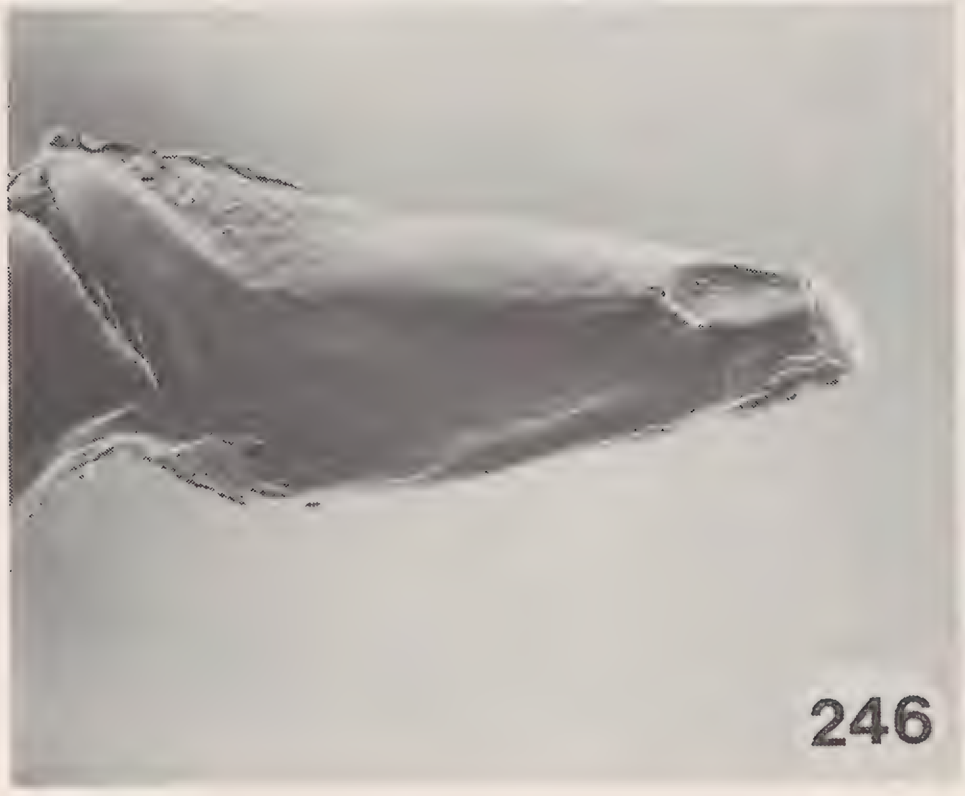
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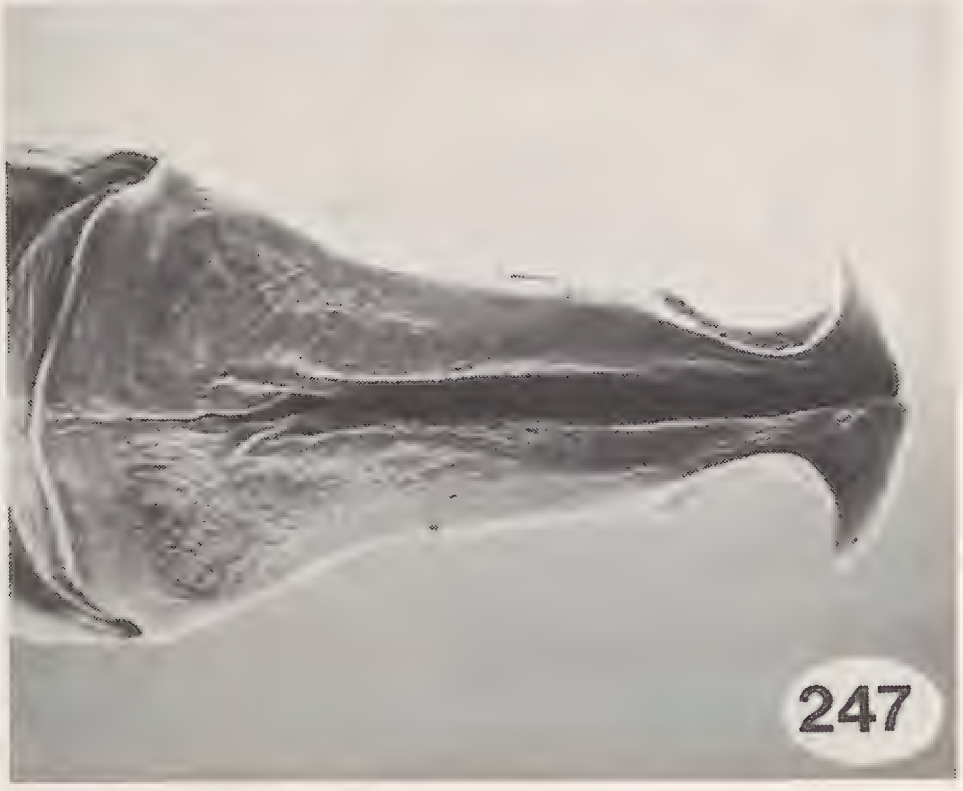
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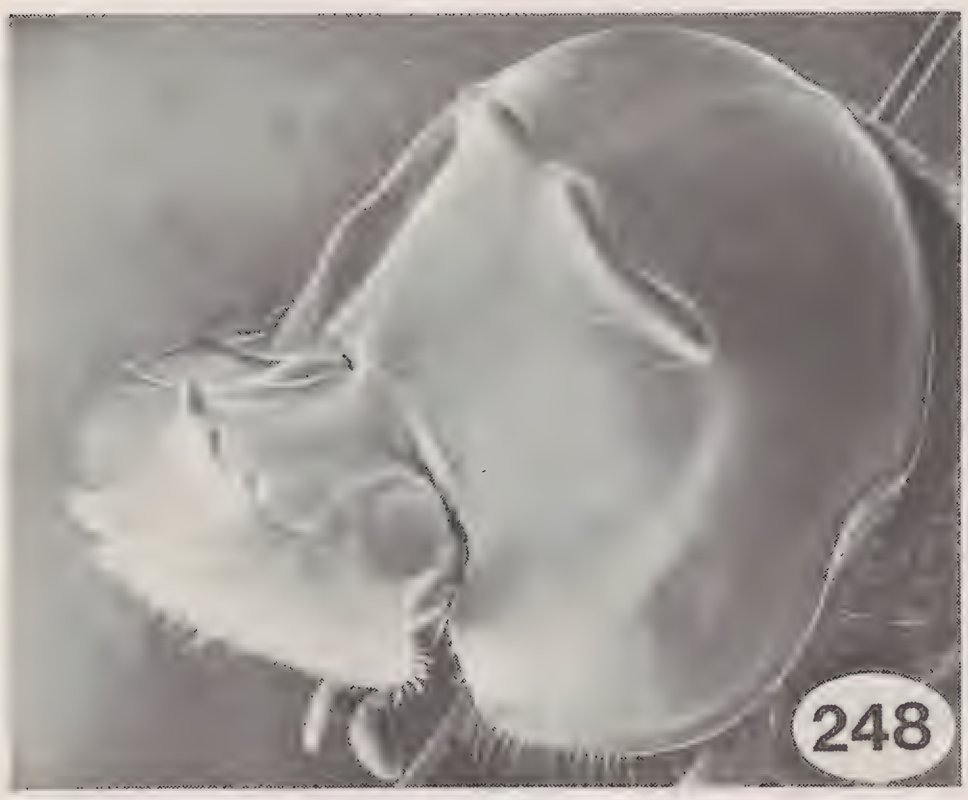
Figs. 242, 243. Coprophanaeus t. corythus (Har.), male genitalia. 242. Lateral view. 243. Dorsal view. Figs. 244-247. Coprophanaeus chiriquensis Ols., male. 244. Dorsum. 245. Head and pronotum. 246. Genitalia, lateral view. 247. Genitalia, dorsal view.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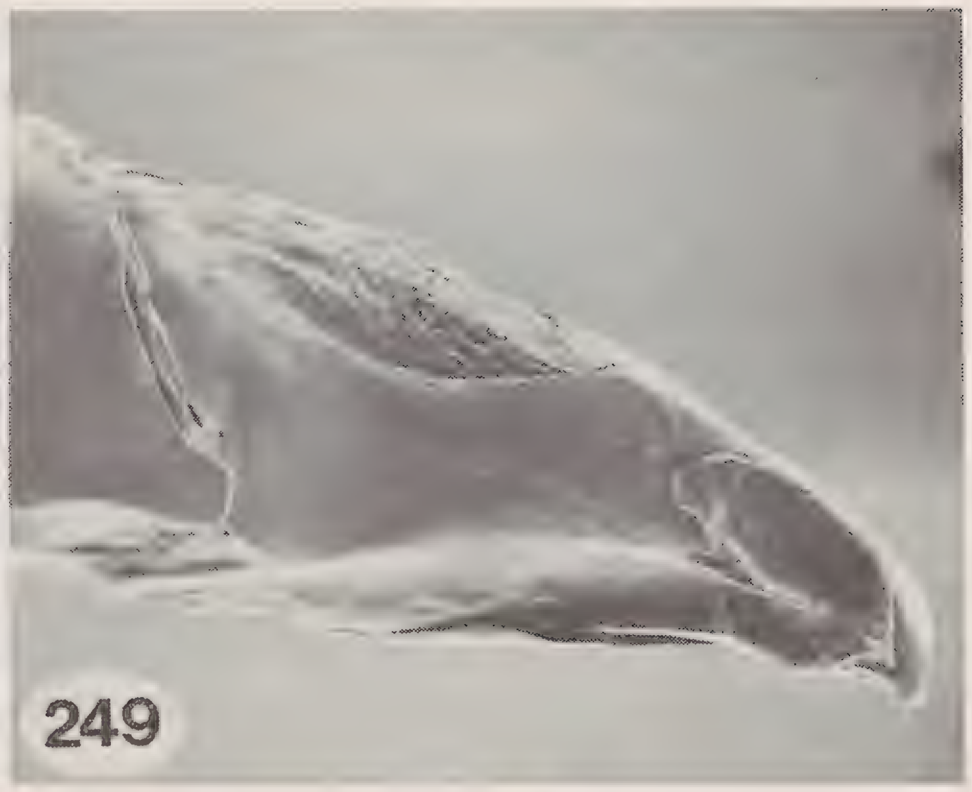
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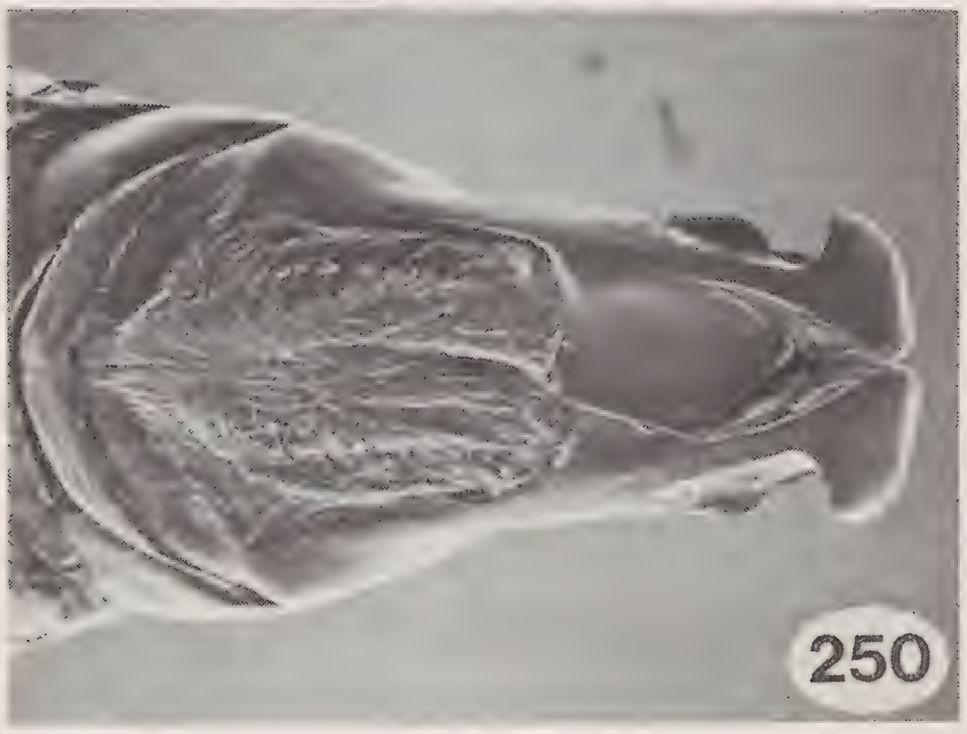
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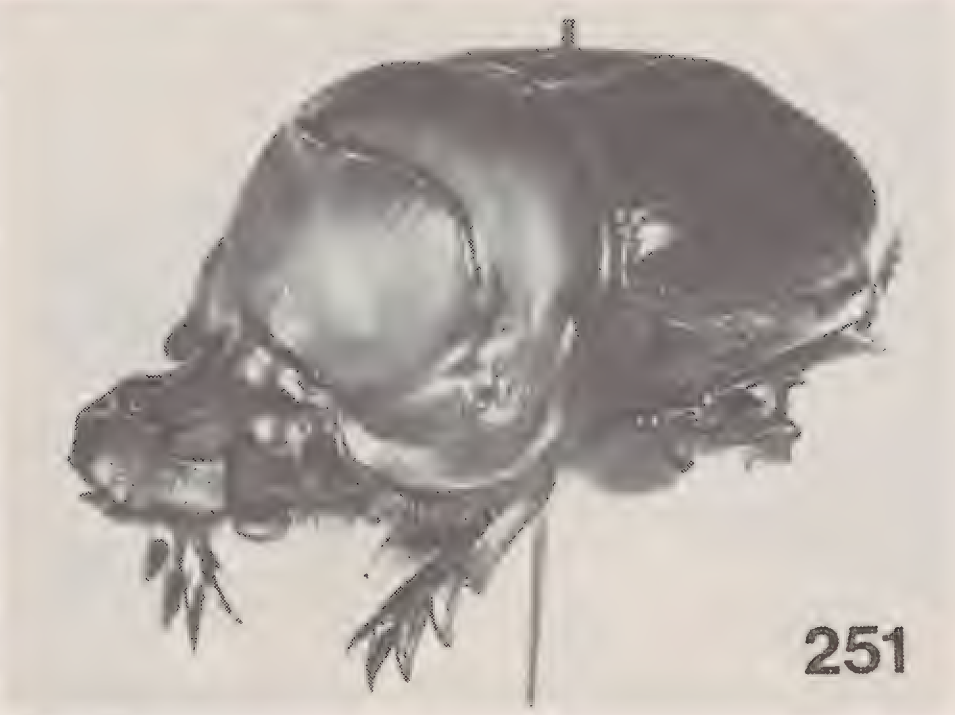
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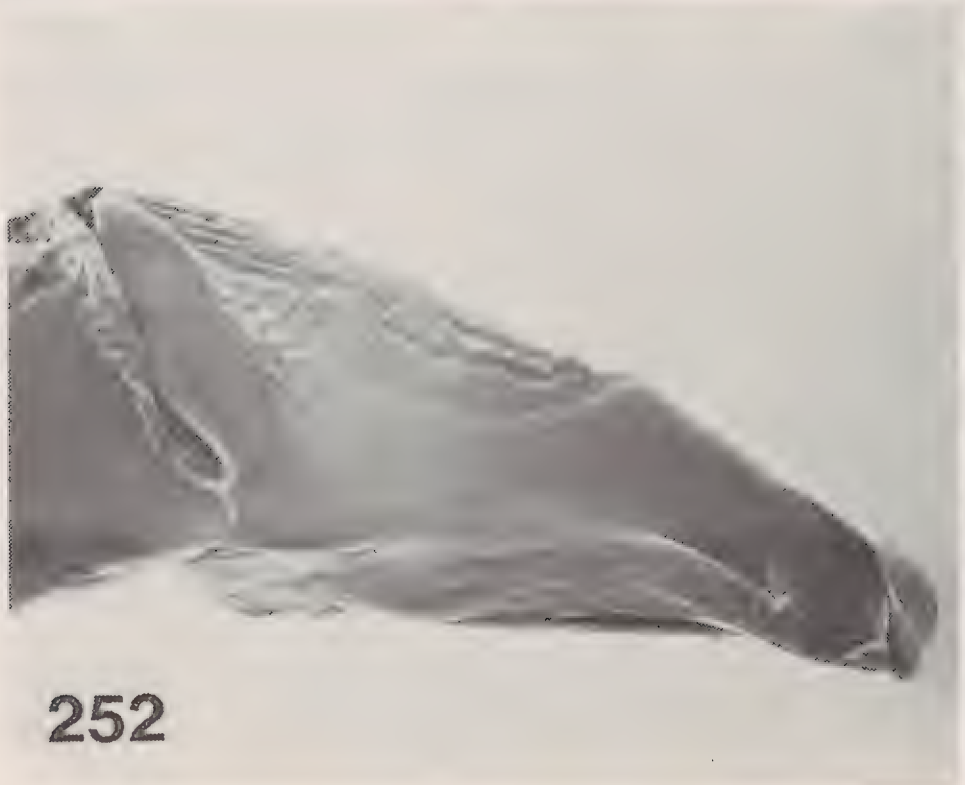
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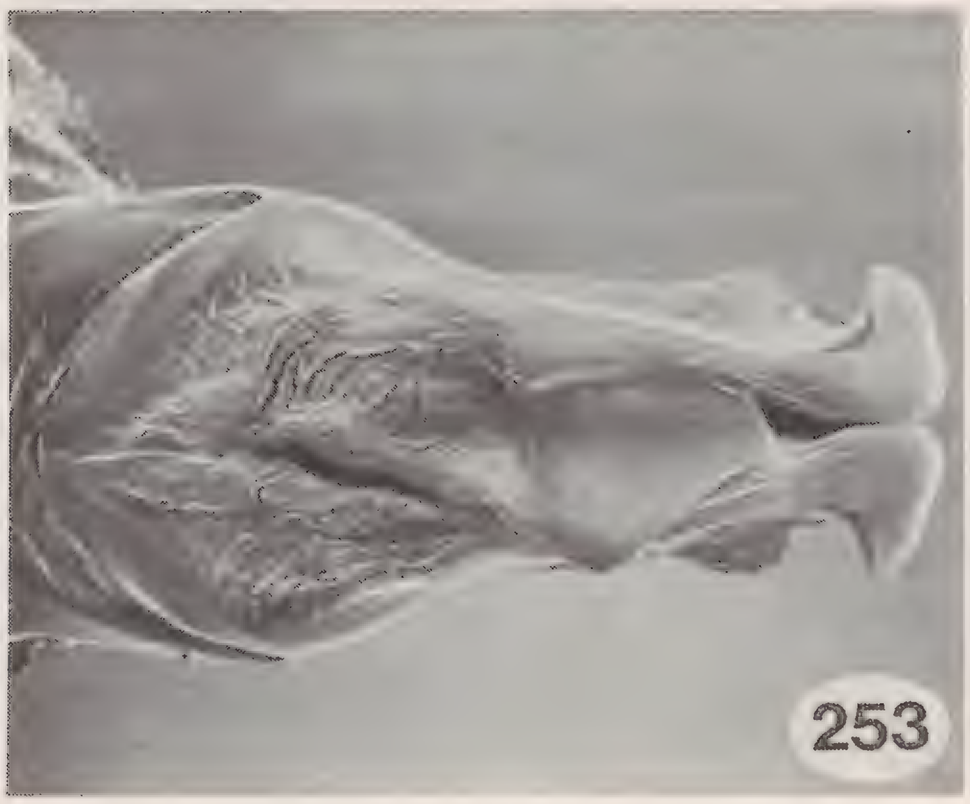
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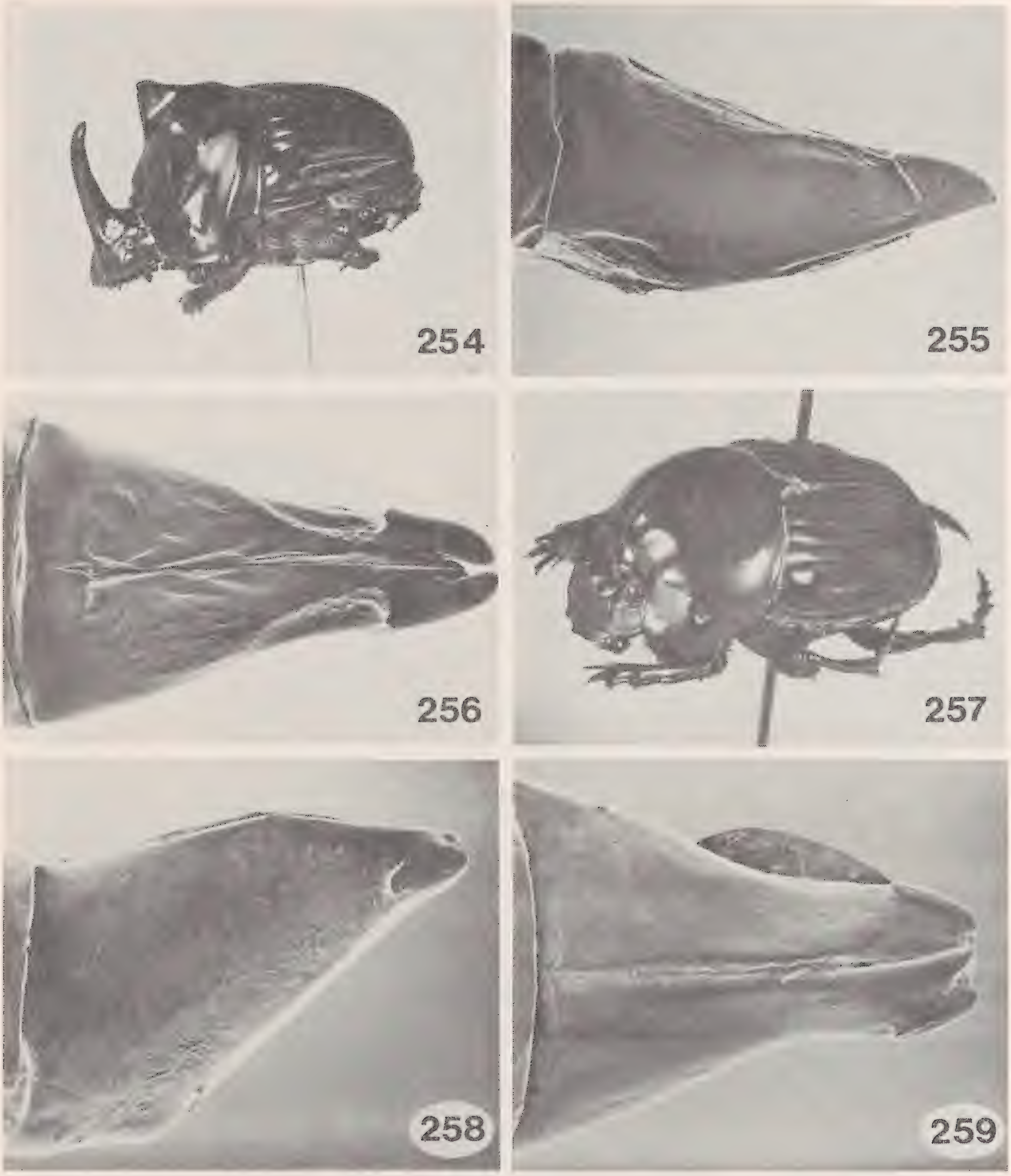
Figs. 248-250. Coprophanaeus ohausi (Felsche), male. 248. Head and pronotum. 249. Genitalia, lateral view. 250. Genitalia, dorsal view. Figs. 251-253. Coprophanaeus pecki n. sp., male. 251. Dorsum. 252. Genitalia, lateral view. 253. Genitalia, dorsal view.



Figs. 254-256. Oxysternon conspicillatum (Web.), male. 254. Dorsum. 255. Genitalia, lateral view. 256. Genitalia, dorsal view. Figs. 257-259. Oxysternon zikani Per., male. 257. Dorsum. 258. Genitalia, lateral view. 259. Genitalia, dorsal view.

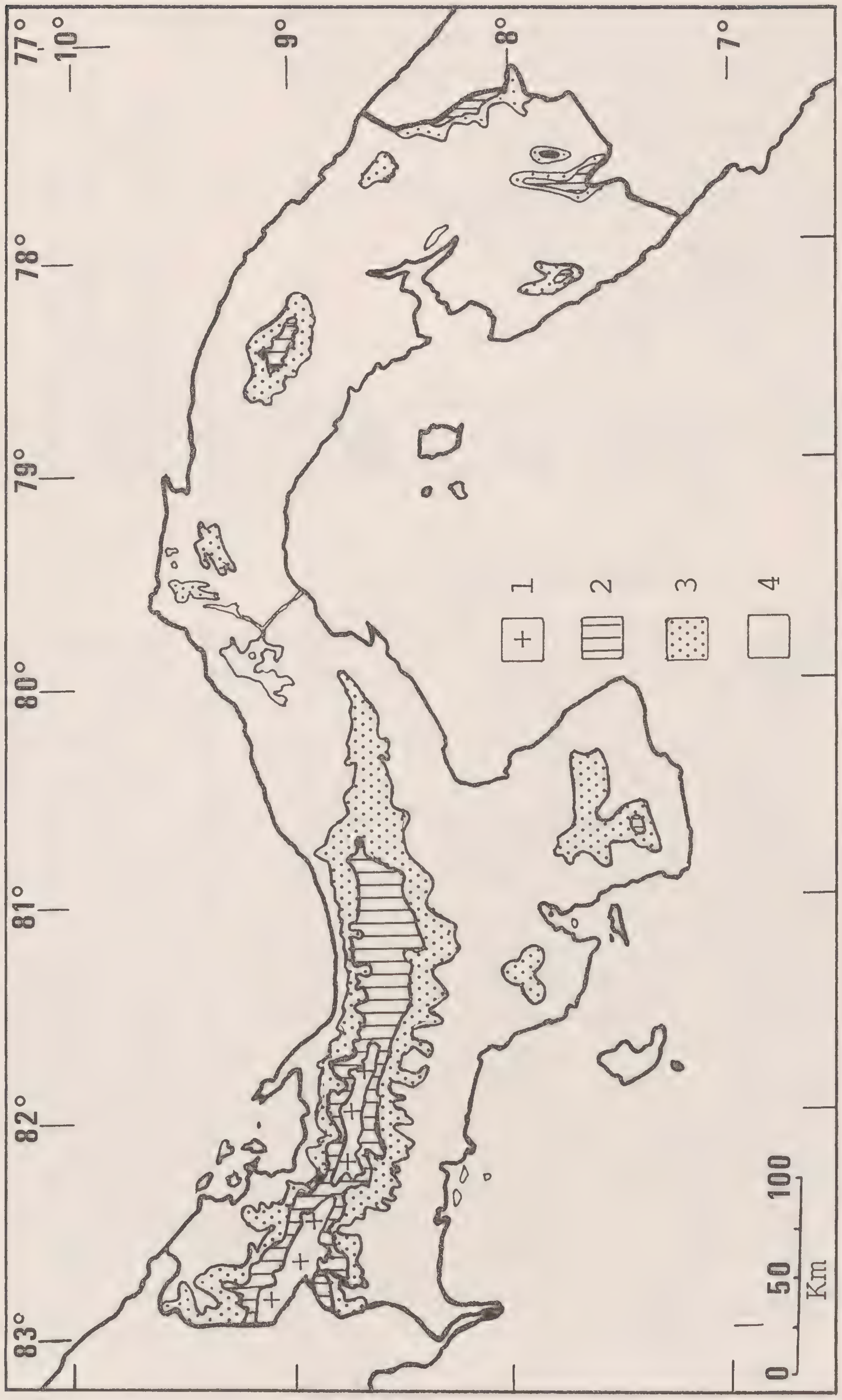


Fig. 260. Panama: Elevations after Porter (1973)

1. 2000 m +
2. 1000 to 2000 m
3. 500 to 1000 m
4. 0 to 500 m

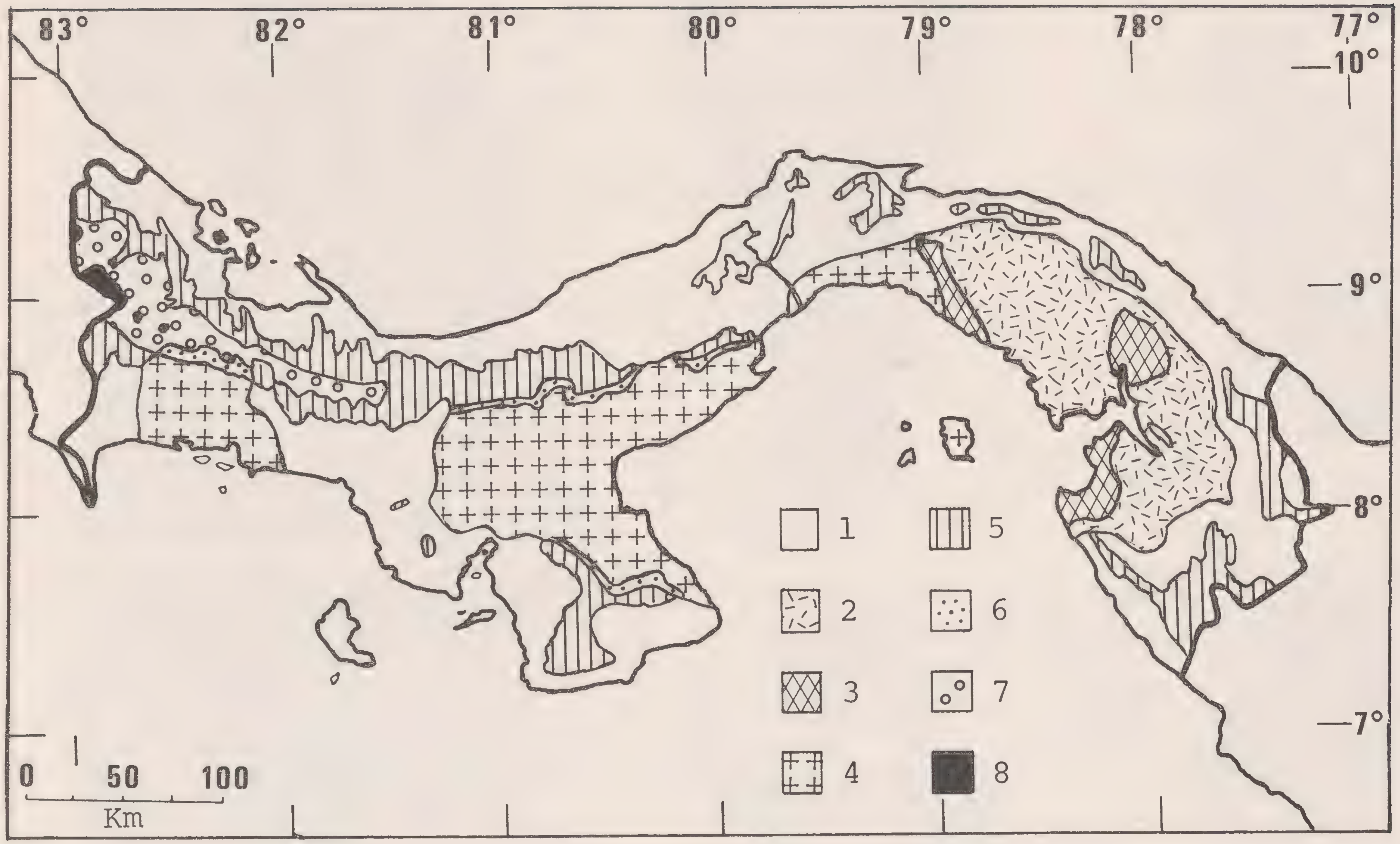


Fig. 261. Panama: Life Zones after Holdridge and Budowski (1956)

1. Tropical Moist Forest
2. Tropical Moist Forest (Transition)
3. Tropical Dry Forest
4. Tropical Dry Forest (Transition)
5. Subtropical Moist Forest
6. Subtropical Dry Forest
7. Lower Montane Wet Forest
8. Montane Wet Forest